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ANPC National Office

GPO Box 1777
Canberra, ACT 2601, Australia

T (02) 6250 9509 | **F** (02) 6250 9599
E anpc@anpc.asn.au
W www.anpc.asn.au

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E info@nzpcn.org.nz
W www.nzpcn.org.nz

Front cover: *Acacia wollarensis* flowers.
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Editor
Heidi Zimmer

Associate Editors
Nathan Emery and Selga Harrington

Editorial Team
Kate Brown, Paul Gibson-Roy, Melissa Miller, Cathy Offord, Kylie Moritz and Jo Lynch

Layout & Graphic Design
Siobhan Duffy

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Australasian Plant Conservation is a forum for information exchange for all those involved in plant conservation: please use it to share your work with others. Articles, information snippets, details of new publications or research and diary dates are welcome. General articles on any plant conservation issue are most welcome.

The deadline for the **December 2018 – February 2019 issue is 9th November 2018**. The special theme for the issue is **Translocation of threatened plants – Part 3.** If you are intending to submit an article or wish to discuss possibilities, please email the editor, Heidi Zimmer: **editor@anpc.asn.au**

Authors are encouraged to submit images with articles or information. Please submit images in electronic format, resolution needs to be at least 300 dpi, at least the size that they are to be published, in tif, jpg or gif format. Guidelines for authors and an article template are at: **http://www.anpc.asn.au/apc**.

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From the editors

HEIDI ZIMMER, NATHAN EMERY AND SELGA HARRINGTON

Welcome to issue 27(2) of *Australasian Plant Conservation* (APC), where we focus on threatened plant conservation from the ecological consultant's perspective. This issue includes six articles from ecological consultants, and we hope it inspires more ecological consultants to submit articles to APC into the future.

We begin with a "call to arms" from Stephen Bell, who outlines the case for ecological consultants to share the findings from their threatened species surveys, citing a range of examples of where ecological consultancy work has been fundamental to increasing our understanding of threatened plant species. Next, Rachel Musgrave highlights the importance of threatened species databases being up to date – so that other botanists working in these locations, or nearby, are made aware of the potential for these species to be present. To this end (and similar to Stephen Bell's article), she calls on ecological consultants to share their records.

Chantelle Doyle and Belinda Pellow's report on *Thesium australe* populations from the Mount Kaputar region highlights the importance of sharing observational data from the field to identify target populations that may be widely spread but are sparse in abundance, as well as commonly associated species. Stephen Bell and Ryan Sims' article on *Dracophyllum macranthum* is a call for more targeted surveys of threatened plant species to guide future management strategies and inform threatened species assessments and listings. This will then help resources to be directed to where they are needed most.

Fiona Sutton and Matthew Dell describe a monitoring program investigating re-establishment of coastal saltmarsh vegetation following work to reinstate a more natural topography and tidal regime to a former water treatment pond. This provides an example of how restoration can be achieved with limited financial input or replanting if natural processes are reinstated. Lukas Clews discusses the many opportunities where consultants can persue to ensure conservation outcomes are considered and incorporated into development through planning, design and construction stages of development projects.

In our regular features we have news from the Australian Seed Bank Partnership in the form of a story from their Crop Wild Relatives project about capacity building for Indigenous traditional owners at Kakadu National Park and international scientists from Papua New Guinea and West Papua. Next, Rachel Musgrave, intrepid ecological consultant is the subject of our ANPC member profile. In what we hope will become a new regular feature, we profile a regional botanic garden – this time in Orange, NSW. Please get in touch with us if you're involved with a regional botanic garden and would like to have it featured in APC. The book review is on "Recovering Australian Threatened Species – A Book of Hope", edited by Stephen Garnett *et al*., full of positive stories from the conservation world. We end with news from Australia and around the world, and a comprehensive overview of articles relevant to plant conservation from the scientific literature. Happy reading!

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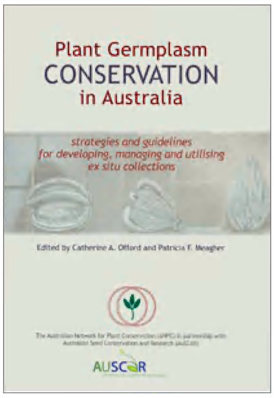

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AUSCOR

The responsibilities of ecological consultants in disseminating outcomes from threatened species surveys: a call to arms

STEPHEN BELL

Eastcoast Flora Survey, Newcastle NSW, and School of Environmental and Life Sciences, University of Newcastle, NSW.
Email: stephen.bell@newcastle.edu.au

Introduction

Ecological consultants are often in the enviable position of being paid to botanically explore and seek out threatened plants. Yes, there are attractive jobs in remote or pristine locations where few botanists have trod before, but there are also less desirable projects in weed-infested remnants across highly fragmented landscapes or in heavily urbanised environments. Both offer the potential to uncover important information on threatened plants. But are we, as consultants, fulfilling our responsibilities for the cause of conservation by disseminating the outcomes of threatened species surveys and monitoring? The pages of *Australasian Plant Conservation*, for example, are largely filled with articles prepared by university and government agency researchers, but consultants seldom feature. Why is this, when consultants are perhaps some of the few professional botanists where much of their time is spent collecting data on threatened species?

Opportunities and responsibilities

With any profession there are opportunities, and ecological consultants are no exception. Granted, a large number of contracts are associated with the development industry, requiring general perhaps monotonous flora surveys to be undertaken to determine if any species of significance are present in an area. These can, and often do, result in lists of common species and weeds with no presence of threatened species. But other more rewarding contracts allow new understandings of specific taxa or groups of taxa, or present opportunities to explore large tracts of privately-owned lands, and it is with jobs like these that consultants can make a real contribution to knowledge on threatened species.

In some situations, even those repetitive more general flora surveys on a development site can result in the re-discovery of species previously thought extinct, or in some cases the discovery of entirely new taxa. *Hibbertia fumana*, for example, was known only from herbarium specimens collected in Sydney in the early 1800s but was surprisingly re-discovered in abundance following routine surveys conducted by consultants for a proposed development (Duretto *et al*. 2017). *Callistemon megalongensis*, newly discovered in the western Blue Mountains of NSW, was present within a standard floristic survey plot being undertaken for a contract mapping project on behalf of the governing council (Douglas 2003), and *Acacia wollarensis* was detected and recognised as a new species only through inspection by consultants of a proposed offset property in the upper Hunter Valley of NSW (Bell and Driscoll 2017). The critically endangered *Persoonia pauciflora* was discovered through contract flora surveys of a proposed development site in central eastern NSW (Weston 1999), while in WA *Tetratheca paynterae* subsp. *cremnobata* and *T. erubescens* were both uncovered as a result of commissioned surveys of lands on behalf of the mining industry (Bull 2007). In some cases, plant taxonomists choose to name a new taxon after their consultant discoverers (e.g., *Haloragis milesiae*, Wilson and Makinson 2015; *Leptospermum benwellii*, Bean 2004; *Zieria odorifera* subsp. *copelandii*, Duretto and Forster 2008). In all of these cases, persistence and careful observation by consultants in sampling vegetation during otherwise routine surveys has uncovered critical new finds.

Ecological consultants work under a number of responsibilities, and these will depend on the type of survey being contracted, the desires of clients for project confidentiality, and the conditions imposed on them by licencing agreements in place with government agencies. Above all of these, however, is the responsibility for the advancement of science and dissemination of information that can assist conservation. Over two decades ago, Kitching (1994) suggested that we all have a responsibility to the rest of nature, to observe and defend it through all means possible, and that should include circulating our findings to aid species protection. Under the International Convention on Biological Diversity, signatory countries are obliged to investigate and manage biodiversity for the benefit of all. Australia has been a signatory to this Convention since 1992, and since that time state and federal jurisdictions have implemented legislation to ensure that biodiversity is managed in an ethical and righteous manner. Ecological consultants play a key role in this, for it is they who are at 'the coal face' as they document biodiversity and highlight taxa of significance to meet the requirements of this legislation. And as indicated in the examples quoted above, ecological consultants often play a crucial role in the advancement of taxonomy, a role where collaboration with taxonomists can greatly assist the accelerated discovery of new species anticipated under the decadal plan for taxonomy in Australia (TDPWG 2018).

Publish – but where?

So how can we disseminate important findings? Even seemingly minor outcomes from surveys can improve management of a species, and publication of these data to a wide audience is highly desirable. Publication of important and significant new findings does not always need to comprise a detailed and lengthy ecological study of a target species, as may be suitable for a scientific journal. In many cases, the critical findings of a project can be summarised in a few paragraphs (such as in the abstract of a full scientific paper), and it is the facts contained in such summaries that often influence how management and policy decisions are made. There are at least three avenues for potential publications open to consultants that are rarely used, and each can potentially contribute to conservation. Bulletins such as *Australasian Plant Conservation* provide the perfect conduit to relay new information on threatened plants and their habitats, but it is unfortunate that ecological consultants rarely contribute. A review of the twenty-six volumes of *Australasian Plant Conservation* published since its inception in 1991 (as *Danthonia*) shows a strong dichotomy between articles penned by government agency staff or community groups and those prepared by ecological consultants (Figure 1). Of 784 articles submitted during this period, only 50 (6.4 %) were prepared solely by ecological consultants, and a further 25 (3.2 %) were collaborations between consultants and agency staff. For a publication that promotes itself as being “a forum for information exchange for all those involved in plant conservation”, ecological consultants, often at the forefront of discovering new populations, extending distributional ranges and uncovering important ecological traits, are letting the team down considerably.

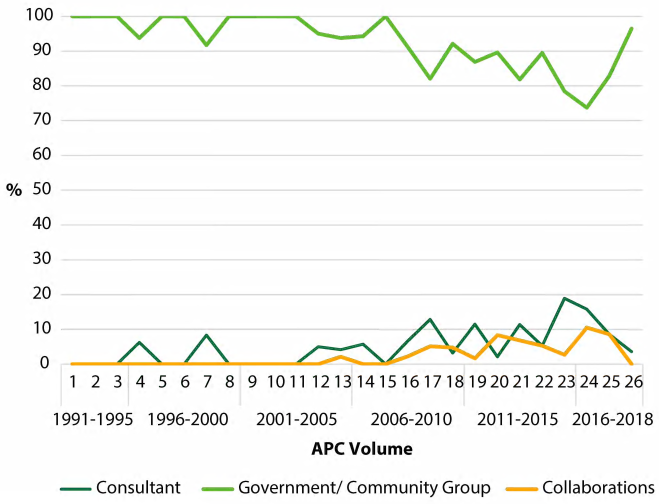

Figure 1. Percentage contributions of ecological consultants and other professionals to APC over the past twenty-seven years (Volume 1-26), 1991 to 2018 (n = 784).

Low publication rates may be acceptable in a profession with limited members, but the number of ecological consultants has undergone rapid growth in recent decades as it keeps pace with legislative expectations. In recognition of this, some States have formed professional bodies to foster, encourage and inform their membership of latest developments. For some, dissemination of information through newsletters or bulletins forms an important communication opportunity for members, and this represents a second avenue for consultants to advise of significant finds. An online search of these organisations in Australia shows that three States are active in this area (NSW, WA, VIC). Two of these (NSW, WA) allow public access to their newsletters and bulletins (*Consulting Ecology; ECA WA News*), and a third (VIC) has an active Facebook account. It is of interest to glean from these publications the extent to which new information and data on threatened plant species are published. Understandably, the bulk of information presented in all of them relates to administrative issues, feedback from workshops and conferences, book reviews and recent research publications, updates on specific taxonomic groups, updates on legislation and government initiatives, new equipment technologies and trials thereof, and general observations from members’ holidays and the like. Very few contributions actually document important new finds or discoveries relating to threatened plants made by members during the course of work activities. This is particularly disturbing, given that organisations established by and for consultants seem to provide the perfect platform for advising colleagues and others of significant finds. By comparison, significant observations relating to fauna are far more evident in these publications and yet there are considerably more threatened plants than animals in all Australian States.

As an example, Figure 2 summarises the relative contributions relating to significant flora and fauna observations published in *Consulting Ecology* (newsletter of the NSW Ecological Consultants Association) from its inception in 1999 until 2017. Rarely do observations relating to threatened flora get a mention, yet newsletters such as this provide a perfect opportunity for distributing new information. Observations on interesting and significant fauna results have consistently outnumbered those on flora. Given that most ecological consultants are time-poor, brief submissions advising colleagues of survey results in a publication such as this should be entirely feasible (and our fauna colleagues seem to be managing this better than us), when the alternative of preparing more detailed scientific papers seems insurmountable.

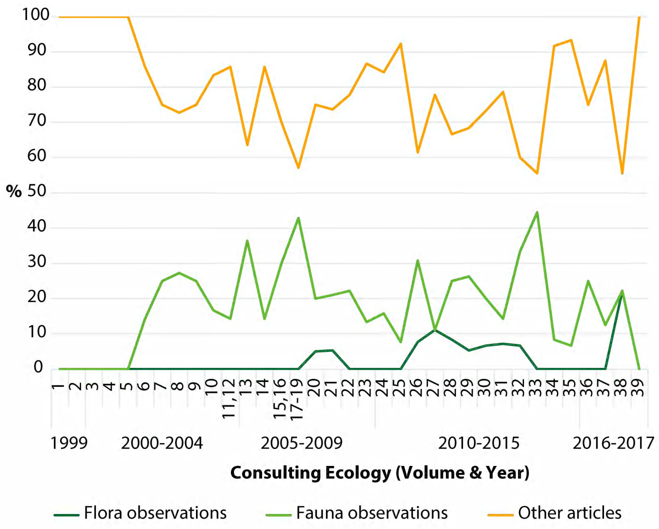

Figure 2. Percentage contributions of flora and fauna observations to Consulting Ecology over the past nineteen years (Volume 1-39), 1999 to 2017 (n = 392).

For those consultants who have the passion and drive to contribute long-term to plant conservation, the field of taxonomy provides a third avenue for potential publication. Taxonomic journals, such as *Austrobaileya, Muelleria, Nuytsia, Swainsona, Telopea,* and *Australian Systematic Botany*, offer opportunities to publish more in-depth studies on the taxonomy of threatened species or groups of species, but few consultants are represented there. Some of the few examples include Bellette (2014), who presented his findings on the distribution and taxonomy of *Xanthorrhoea glauca* subsp. *angustifolia* following extensive examination of specimens in Victoria, and in response to recognised difficulties with taxonomic characters used in their identification: he saw problems in an existing taxonomy and set out to improve it. Similarly, Carr (2006) described *Dianella tenuissima* from the Blue Mountains of NSW as one step towards resolving the poor circumscription of most taxa in this genus. For keen consultants, unusual specimens collected in the field may lead to close collaboration with professional taxonomists and the publication and description of new species.

OK – so what will I publish?

So what sort of observations on threatened plant species can and should be published by ecological consultants? These are many and varied, judging by the following examples that have already been prepared by consultants and published in the literature. Suitable topics could be the outcomes from a specific targeted search for a species or a group of threatened species (e.g., Copeland and Hunter 2005; Murdock *et al*. 2011) or new understandings on a species gained from a specific project (e.g., Payne 2014; Hunter and Hunter 2016; Bell 2017). They could document significant new range extensions or re-discoveries of a species (e.g., Nicholson 1995; Weber 2009) or collate several years of new records for a species from a number of projects to provide an update on distribution or abundance (e.g., Copeland and Hunter 1999; Bell and Driscoll 2005). They could outline trials for new survey techniques (e.g., Fletcher and Erskine 2012; Wapstra and Yates 2016), identify problems in existing taxonomy (e.g., Bell *et al*. 2007; Carr 2007) or contribute to or describe species new to science (e.g., Hunter 1998; Douglas 2003). They could compile observations from one or more surveys to more fully describe the habitat of a species (e.g., Miles and Cameron 2007; Mills 2015), or identify the preferred niches of those species or their response to disturbances (e.g., Hunter *et al*. 1998; Douglas 2005; Bell and Holzinger 2015). They could provide a re-assessment of conservation risk assessment based on existing or new survey data (e.g., Douglas 2009; Bell and Sims submitted), or new threats to a species may be identified (e.g., Heinrich and Dowling 2000). Lessons learnt from translocation projects provide another avenue for publication (such as those detailed in recent issues of APC), as do success stories where threatened species have benefited from collaboration in the face of development (e.g., Honczar 2005). Collaborations between consultants and government agencies or community groups may ease the pressures of consultants finding the time to write up important observations, and there are several cases of such partnerships already in the literature. For example, Allen and Turton (2009) investigated the effects of fire on *Epacris hamiltonii*, Bower *et al*. (2015) examined reproduction and pollination in *Genoplesium littorale*, Patykowski *et al*. (2014) reviewed the conservation ecology of *Pomaderris vacciniifolia*, and Douglas and Wilson (2015) formerly described a new species of bottle brush, *Callistemon purpurascens*.

These are all good examples of how ecological consultants can contribute to conservation planning for threatened plant species. Based on the topics addressed to date by consultants, the range is broad and with a little thought most consultants should be capable of conjuring up at least one article on their observations and data collected over the years. This information is too valuable to remain in the poorly accessed grey literature, and deserves a wider audience.

Conclusions

Ecological consultants are fortunate in that they are granted access to survey plants in remote localities or on government and privately-owned land. Many of these surveys result in the finding of new populations of rare and significant plant species, and often important data on population size, habitat, threats, distribution or ecology is gathered. Once presented to respective clients at the completion of each job, an important next step should be, where appropriate, to disseminate findings more widely. Journals and bulletins (such as those mentioned above), provide an appropriate medium for this so that government authorities and others in management and administrative roles can incorporate this new information into conservation planning. However, it is unfortunate that few consultants possess the will nor the time to publish their findings. But why are consultants so dismissive of publishing? Ambrose (2016) described this as 'the publication dilemma' and provided three key reasons why consultants do not regularly publish: confidentiality agreements with clients, intellectual ownership of data and reports, and lack of time and inclination. These are all legitimate reasons, and Ambrose suggested the answer may come down to a bit of give-and-take between consultants, clients, industry, and government agencies. There is no easy solution, at least in the short term, and realistically the onus will inevitably fall on consultants to devote more work or personal time to preparing publications, with the knowledge that the more they publish the more respected within the industry they will become. Sole traders are more likely to be able to create time to prepare publications than those who work in larger consultancies, however larger organisations should encourage publications from their staff to elevate and promote credibility, both for the individuals involved and the supporting organisation.

And so, a call to arms for all consultants: collect, collate, prepare and publish!

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The full list of references are available in the appendix at: https://www.anpc.asn.au/sites/default/files/apc/APC27-2_Bell_AppendixReferences.pdf

The importance of readily available and accurate information when assessing impacts on threatened flora species

RACHEL MUSGRAVE

SMEC Australia Pty. Ltd., North Sydney, NSW
Email: rachel.musgrave@smec.com

A consultant's quandary

Many botanists who work as consultants are familiar with undertaking flora surveys and impact assessments within places where they have little prior experience or knowledge. Clients' expectations are often that we know everything about the plants and vegetation communities we assess. But this is an unreasonable and impossible expectation – no one person can, or does, know it all.

Furthermore, the nature of consulting means that there are often budget and timing constraints limiting the time spent on site surveying, identifying the plants and vegetation communities, and analysing data. These limitations are generally outside the control of the consultant, imposed by clients with inflexible timeframes, and a lack of appreciation for the complexities of ecological assessment. My weekends can be spent running through keys on PlantNET and conducting literature reviews for threatened species, tasks that often take a lot longer than the budget permits.

The assessment process and guidelines that we follow go some way to addressing these limitations. Nevertheless, one of the primary challenges we face as consultants is completing thorough and accurate impact assessments when information about the plants and vegetation communities we are assessing is difficult to access. Ensuring that data on threatened flora is accurate and readily available for use by consultants is the most important step in establishing a solid foundation of information on which impact assessments can be based, which may in turn assist in improving conservation outcomes.

Overview of the impact assessment process in New South Wales

Within New South Wales, impact assessment requirements are outlined within the NSW *Biodiversity Conservation Act 2016* and when relevant, the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*. The impact assessment process generally starts with a review of available information contained within both state and Commonwealth databases for species that have been recorded within a five kilometre radius of the study area. These databases include:

- NSW Office of Environment and Heritage (OEH) BioNet Atlas.
- Atlas of Living Australia.
- OEH BioNet Vegetation Classification Database.
- OEH Biodiversity Assessment Method (BAM) Calculator.
- Department of Environment and Energy (DoEE) Protected Matters Search Tool.

Once a list of candidate threatened species has been compiled after consulting these databases, an assessment of the likelihood of the species to occur in the study area is undertaken. This process involves assessing the suitability of available habitat on the development site against the specific habitat requirements described for each candidate species, while also taking into account the number, proximity, and age of the threatened species records within the locality. Targeted threatened species surveys are driven by the outcomes of the likelihood of occurrence assessment, with surveys targeting species with a higher likelihood of occurrence, over species that have been assessed as having a lower likelihood of occurrence.

After field surveys are completed, the impact assessment is undertaken. The impact assessment considers both direct and indirect impacts of the proposal on the study area's biodiversity, and will include any assessments required under state and/or Commonwealth legislation such as assessments of significance and offset calculations.

How does this relate to readily available and accurate information?

As discussed above, impact assessment is driven via the records of threatened species within a five kilometre radius on the BioNet Atlas. Consequently, if there are no records of a threatened flora species located within the search area, it is very unlikely that the species will be considered within the assessment even if suitable habitat exists on the site, unless the consulting botanist has access to additional information. The assessment of the likelihood of a threatened flora species occurring on a site can be influenced by the number, age, and

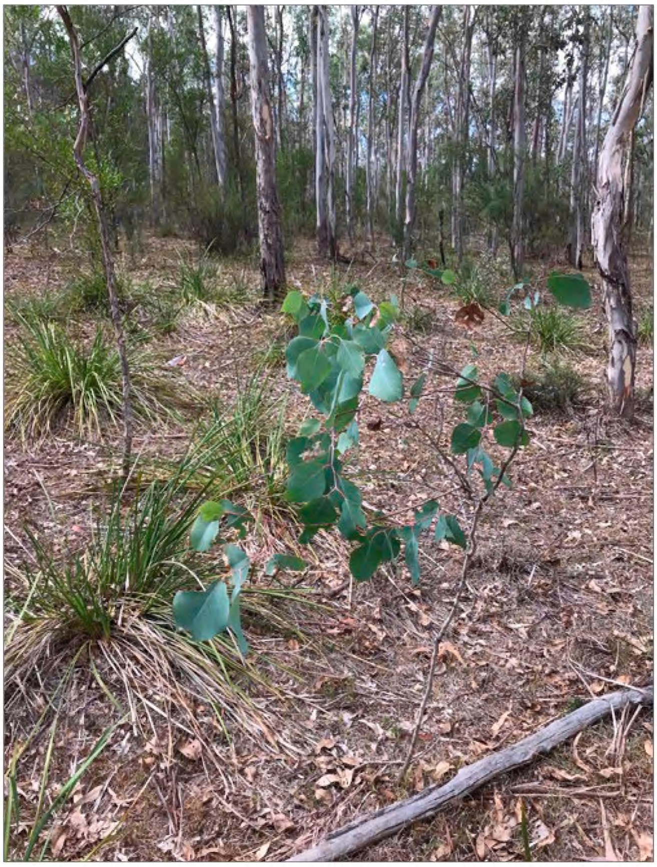

Figure 1. Incidental observation of *Eucalyptus glaucina* occurring outside its known range. Photo: Rachel Musgrave

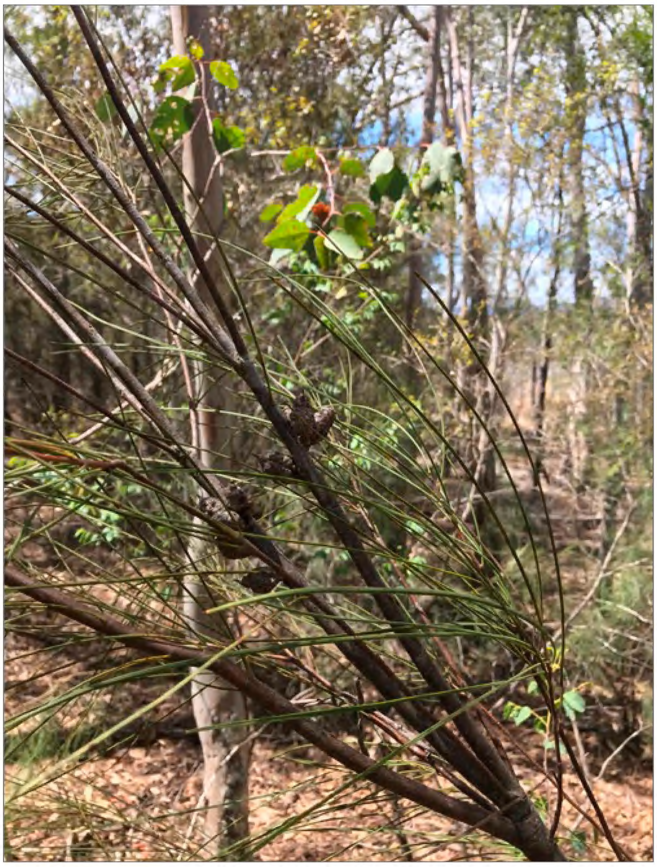

Figure 2. *Hakea dohertyi* within Yerranderie State Conservation Area. Photo: Rachel Musgrave

proximity of records to the development site – a species that has multiple and recent records close to the site may be assessed as more likely to occur than a species with relatively few older records away from the site (assuming similar habitat requirements for both species). With limited time and resources, the consulting botanist is more likely to target the species with a higher likelihood of occurrence.

When there are no records on the BioNet Atlas, it's unlikely that surveys for that species will be carried out, yet existing records can lead to surveys that may generate more records. In this way, false absences may be compounded by no subsequent surveys by consultants. For example, OEH records over the last 15 years for a threatened species that were not entered on the Atlas until recently has meant that there were no records for this species in this part of western Sydney. As a result, it is unlikely that consultants would have carried out surveys for this species, even though it may have occurred on development sites.

Incidental observations may include novel occurrences, which cannot be predicted through these processes. Novel occurrences in terms of range, plant associations or edaphic and landscape features are only incidentally noted through good field botany, rather than Atlas records or ecological information on databases. For example, *Callistemon linearifolius* and *Eucalyptus glaucina* recently recorded within the Warragamba Dam catchment are significant range extensions discovered through such incidental observations. Budget and time constraints can limit the time consultants spend botanising, thus reducing the likelihood that novel occurrences will be detected.

Consulting botanists survey for, and assess impacts on, a large number of species from numerous families over a wide area. Threatened species profiles published by OEH, BioNet and environmental impact assessment guidelines for various threatened flora species can assist consultants in assessing habitat suitability, planning targeted surveys, assessing impacts, or managing threatened species as part of management plans. For some threatened species these profiles, databases and guidelines are the sole resources that we are able to access about the species in question. However, these OEH resources are not always updated to reflect current understanding about threatened species ecology or distribution. For example, the profile and BioNet information for the Critically Endangered *Prostanthera marifolia* does not include currently understood habitat and community associations. Without access to current information relating to threatened species, the accuracy of the assessment is compromised. Communication with other ecologists is important and can initiate or support additional considerations, but professional networks are variable in nature and important sources of information are lost when experts lose contact.

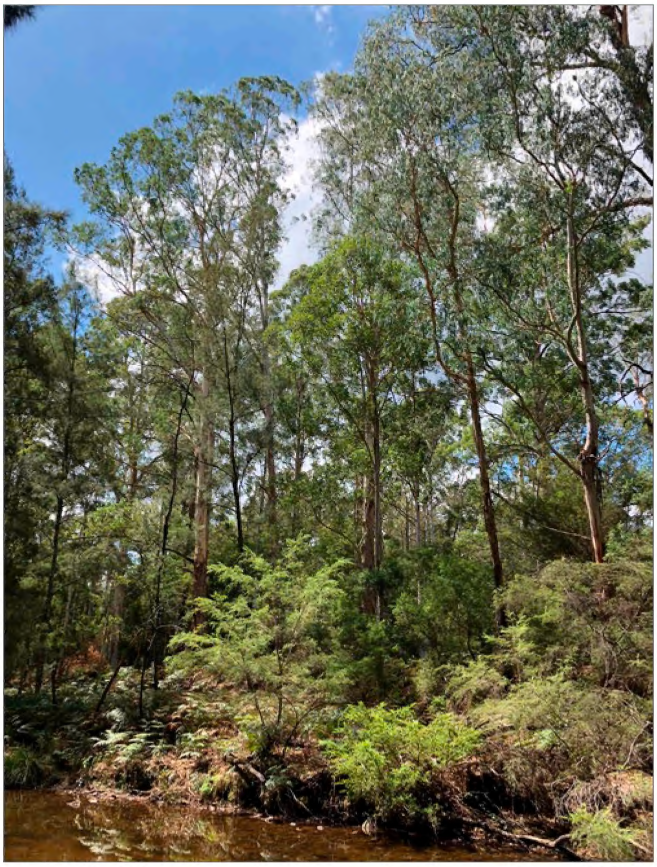

Figure 3. River-Flat Eucalypt Forest on Coastal Floodplains Endangered Ecological Community. Photo: Rachel Musgrave

The assessment process is driven by information contained in a few databases, and incorrect or unreliable data could result in inaccurate impact assessments and poor conservation outcomes. Assessment processes may confirm and reinforce currently understood ecology of threatened species, through data collection bias, potentially inhibiting the detection of different habitat preferences to those currently understood. A positive feedback loop may develop as the assessment process becomes more reliant on tools that predict species presence based on habitat surrogates, while incidental observations of novel occurrences become less frequent.

Conclusion

Utilising databases with current information will be key to ensuring that impacts to threatened species are adequately assessed. It is important that botanists actively participate in the tools and databases consultants use – submit records to OEH for inclusion into BioNet, update the relevant OEH threatened species officer with range extensions and adjustments to habitat preferences, and contribute to professional networks so that consultants have current data on the threatened species being assessed.

Thesium australe: hardly there or simply hard to find?

CHANTELLE DOYLE AND BELINDA PELLOW

AMBS Ecology and Heritage, 1/33Booth St, Annandale NSW 2038.
Email: chantelle@ambs.com.au

Background

In the course of our work as field ecologists, we often encounter cryptic or poorly described threatened species. Due to the nature of consulting work, anecdotal information about species habitats or life histories often goes undocumented and is only shared with immediate networks on a needs to know basis. Part of the ANPC's goal is to conserve and promote floristic diversity, and we hope the following profile contributes to public knowledge about the elusive species *Thesium australe* R.Br. (Australe toadflax).

Species information

Thesium australe is listed as vulnerable under both NSW and Commonwealth legislation. The species belongs to the family Santalaceae and is described as a straggling herb to 40 cm tall, with pale green to yellow-green foliage and a succulent appearance (OEH 2017) (Figure 1). It is described as growing in grassland or woodland, often in damp sites; has a wide distribution but occurs rarely across its range (PlantNET 2017). Members of the Santalaceae family are semi parasitic usually on the roots of other plants (PlantNet 2017). *Thesium australe* is believed to have a parasitic association with the native tussock grass, *Themeda triandra* (OEH 2017). Little other habitat information is available.

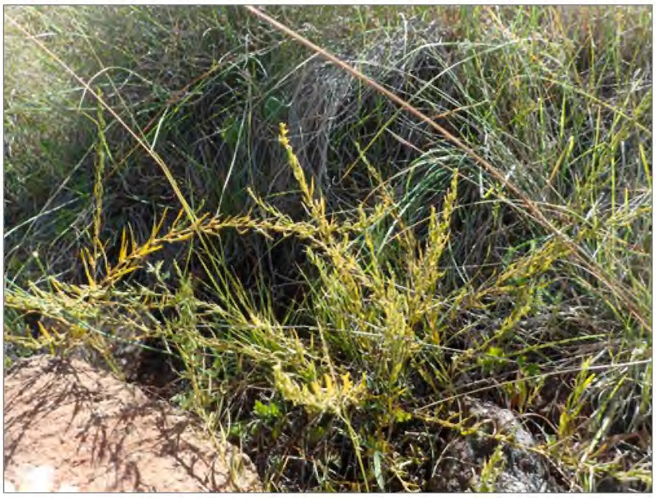

Figure 1. *Thesium australe* a succulent straggling herb with pale green to yellow green foliage. Photo: Chantelle Doyle

Field survey methods

Threatened species searches were conducted in cleared to semi-cleared woodland dominated by *Eucalyptus albens* (White Box) near Mount Kaputar National Park in October and December 2016. Climatic conditions preceding the surveys were wet with higher than average spring rainfall (319.6 mm in September, 130.6 mm in October, compared with an average of 82.1 mm and 79.4 mm respectively) recorded at the Mount Kaputar National Park monitoring station (BOM 2017). *Thesium australe* was expected to occur in the area, based on BioNET Atlas Records (BioNET 2017). A specimen was initially collected incidentally on the 22nd of October and its identification was subsequently confirmed by the NSW Herbarium. Further surveys between 10th and 11th December identified two additional populations. The populations were separated by a distance of at least 10 kilometres.

Results

Habitat and associated vegetation

At all locations *Thesium australe* was growing in tussock grassland, associated with dense tussocks of *Sorghum leiocladum, Poa labillardieri* subsp. *labillardieri*, and in some locations *Themeda triandra* was also present. Other grass species in the *Thesium australe* habitat were *Cymbopogon refractus, Elymus scaber, Rytidosperma racemosum* var. *racemosum, Dichelachne sieberiana* and *Dichanthium sericeum*. Associated shrubs and forbs included *Swainsona galegifolia, Dodonaea viscosa* subsp. *angustifolia, Hypericum gramineum, Hydrocotyle laxiflora, Polygala japonica, Chrysocephalum apiculatum, Scutellaria humilis* and *Leptorhynchos squamatus*. Canopy cover in all locations was sparse most likely due to rocky outcropping or because of clearing.

All populations were located in areas of shallow surface soil and exposed basalt rocks on sloping sites with evidence of water seepage (Figure 2). Elevation varied between 900 m and 1020 m and sites were facing north-east or south-west.

Population size

Populations were limited in extent, the sizes of each population being approximately 0.90 ha (41 ha potential habitat), 0.5 ha (0.90 ha potential habitat) and 0.2 ha (1.7 ha potential habitat) respectively. The number of discrete individuals within each area was difficult to determine but population sizes varied between approximately 10 plants in the 0.2 ha population and >50 in the 0.9 ha population. Plants were flowering and fruiting at the time of collection (Figure 3). The age of individuals was not known but all plants were less than 0.5 m tall.

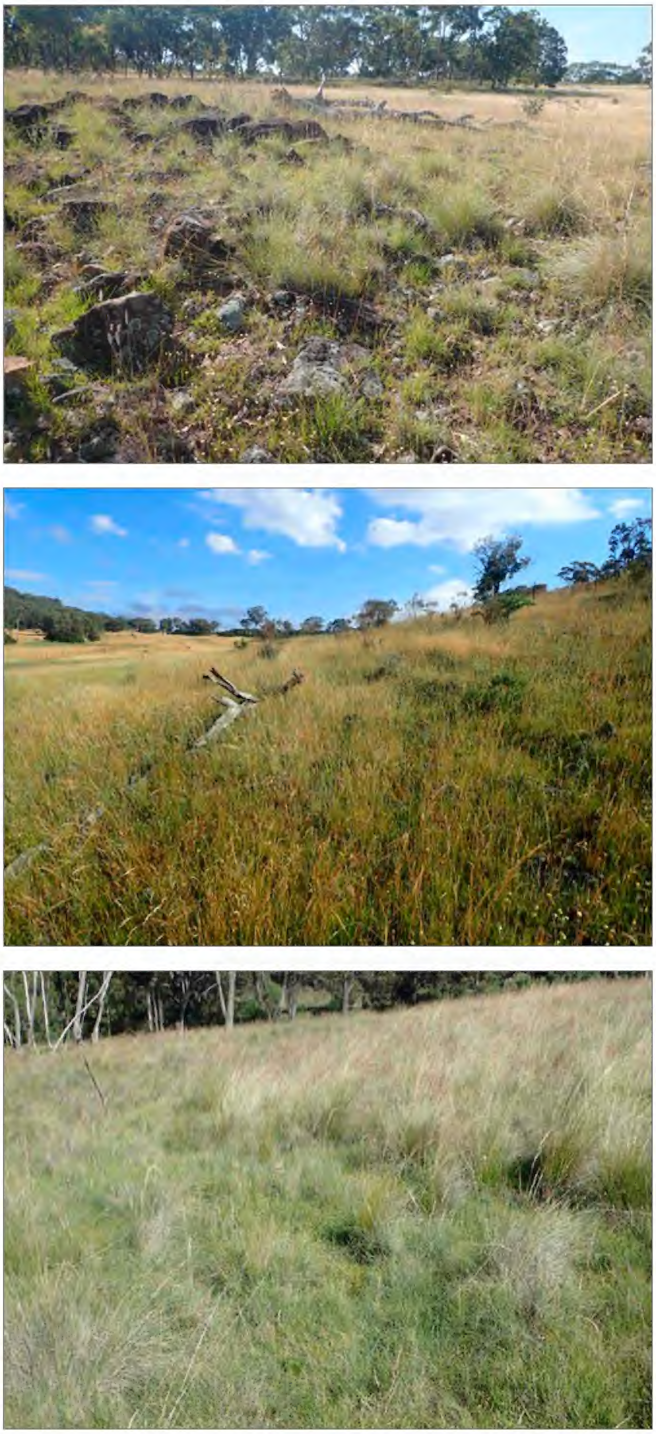

Figure 2. Three examples of *Thesium australe* habitat. All three populations have a rocky subsurface, which probably has slow seepage and may retain moisture following large rainfall events. Photos: Chantelle Doyle

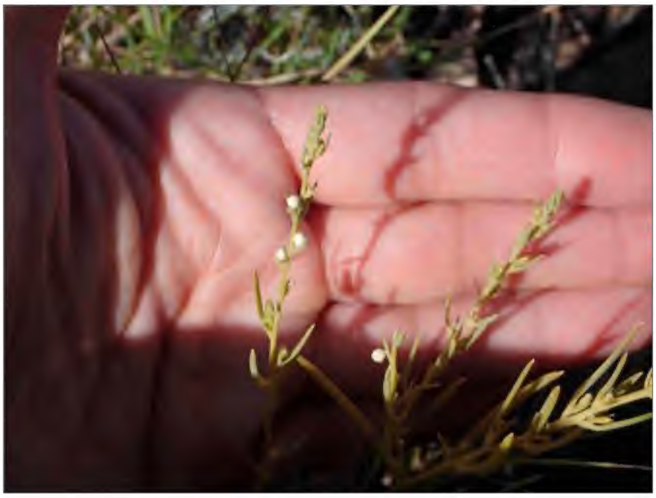

Figure 3. Fruiting *Thesium australe.* Photo: Chantelle Doyle

Conclusion and recommendations

All populations were located in rocky, sloping areas where water seepage appeared to occur and where sites did not receive full sunlight all day long. *Thesium australe* is described as being commonly associated with *Themeda triandra* (OEH 2017), however our observation indicated that a range of native tussock grasses may be suitable since *Themeda triandra* was sparsely distributed and often not in close association with a *Thesium* plant. However, the native tussock grasses *Sorghum leiocladum* and *Poa labillardieri* subsp. *labillardieri* were very common and were dominant species where *Thesium* occurred. Further research is required to identify species/host associations, reproductive strategies (asexual and/or sexual) and germination/growth triggers for *Thesium australe*.

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Extensive populations of *Dracophyllum macranthum* (Ericaceae) in Coorabakh National Park suggest a review of threat status

STEPHEN BELL[1]* AND RYAN SIMS[2]

[1]School of Environmental and Life Sciences, University of Newcastle, NSW
[2]Key Botany, Newcastle, NSW
*Email: stephen.bell@newcastle.edu.au

Introduction

Dracophyllum macranthum E.A.Br. & N.Streiber (Ericaceae) is a weakly erect to spreading or decumbent shrub (Figures 1 and 2) occurring within a restricted range in the rugged forests north of Taree in northern New South Wales (NSW). Described late last century (Brown and Streiber 1999), *Dracophyllum macranthum* is disjunct and distinct from the three other NSW species in the genus by the basipetal flowering habit (maturing from the apex of the inflorescence to the base). Listed as vulnerable on the NSW *Biodiversity Conservation Act 2016* (BC Act), this species has been allocated to the *site-managed stream* under the NSW Government's *Saving our Species* program (SoS)[1]. Representation of *Dracophyllum macranthum* within secure land tenure includes its presence in Coorabakh National Park (NP), and the adjacent Lansdowne and Comboyne State Forests (SF).

To date, no comprehensive and targeted surveys have been conducted for this species, although opportunistic records within existing databases are numerous and encompass several decades. The majority of observations have been made from the Newbys Creek catchment, specifically the Newbys Cave area, within the Lansdowne SF which adjoins Coorabakh NP. Apart from information contained in Brown and Streiber (1999), NSW Scientific Committee (2008), herbarium collection notes and advice from local land managers, there is little available data on habitat or population size for this species. The NSW Scientific Committee (2008) estimated an upper population size of 5,000 individuals, based on limited reconnaissance.

Between 2016-2017, a SoS project established monitoring plots within stands of *Dracophyllum* at Coorabakh NP, and it was postulated then that sizeable populations may

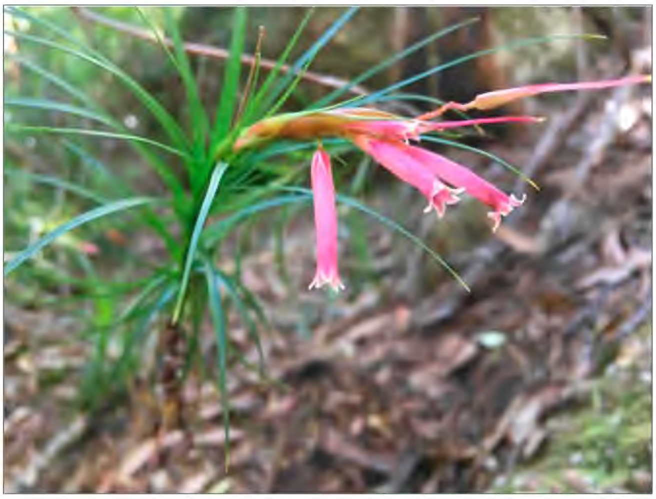

Figure 1. Flowering *Dracophyllum macranthum*. Photo: Ryan Sims

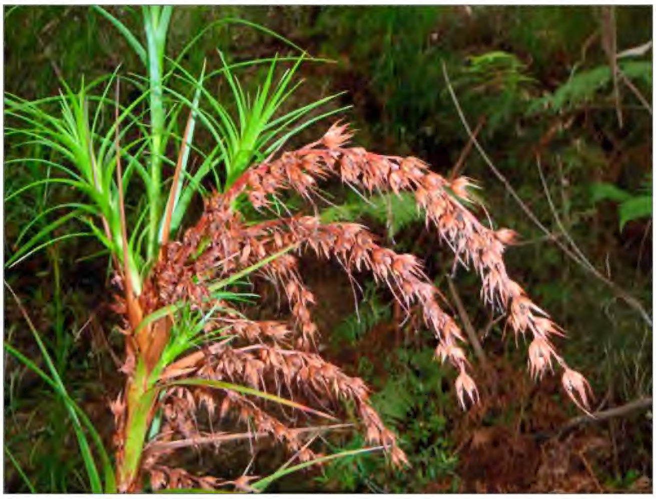

Figure 2. Mature *Dracophyllum macranthum* with old seed heads. Photo: Stephen Bell

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[1] http://www.environment.nsw.gov.au/savingourspeciesapp/Project.aspx?results=c&ProfileID=10514

be present in the more remote and rugged gorges of the park away from the existing trail network and their associated threats. Therefore, a dedicated action under the 2017-2018 SoS program has targeted some of these locations for further survey, primarily to determine if a change in management stream (from *site managed* to *keep watch*) may be warranted.

Habitat

Dracophyllum macranthum almost exclusively inhabits rocky conglomerate cliff lines and boulders with some access to light and water seepage (Figures 3 and 4). Potentially suitable habitat along major drainage lines enveloped by rainforest vegetation is rarely occupied, unless a sizeable canopy gap is present, or rock substrates extend into the sub-canopy. The largest populations occur on tall cliff lines that have a southerly or easterly aspect, thus avoiding the drying effect of the westerly sun during summer. On sheltered slopes where Blackbutt (*Eucalyptus pilularis*) and Blue-leaved Stringybark (*E. agglomerata*) form an open forest, conglomerate boulders are often colonised by *Dracophyllum* (Figure 5), occasionally giving the appearance of the species growing directly in soil (Figure 6). During our field surveys, only one instance of plants growing in soil was observed – on an upper ridge slope where evidence of past soil disturbance through forestry operations was present. On rocky cliff lines, other lithophytic species commonly co-occurring with *Dracophyllum* are *Epacris calvertiana,* Yellow Rock Orchid (*Cestichis reflexa*), and *Dendrobium* spp., together with Pouched Coral Fern (*Gleichenia dicarpa*), Umbrella Fern (*Sticherus flabellatus*) and *Gahnia insignis* in associated areas. A moss layer on top of rock surfaces appear to provide a suitable substrate for young *Dracophyllum* to settle, germinate, and anchor root systems.

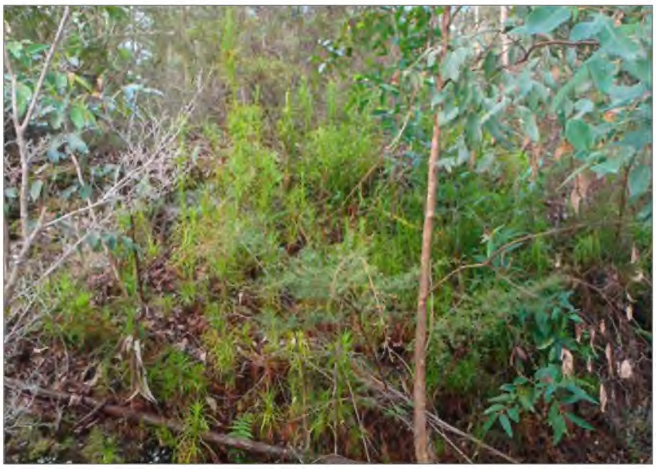

Figure 3. Large boulder within *Eucalyptus pilularis* forest, colonised by *Dracophyllum macranthum*. Photo: Stephen Bell

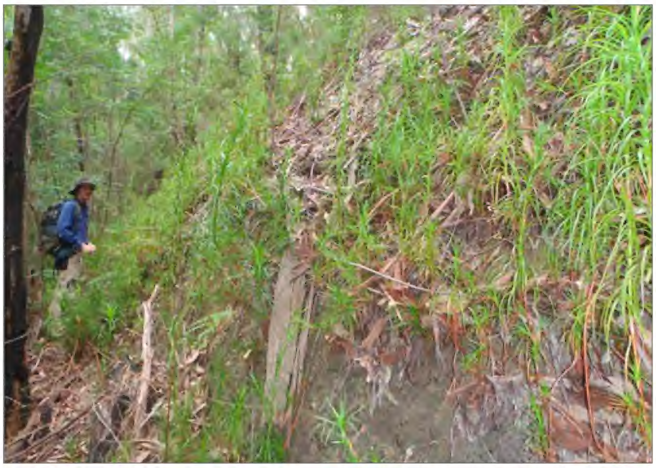

Figure 4. Small cliff line habitat colonised by *Dracophyllum macranthum*. Photo: Stephen Bell

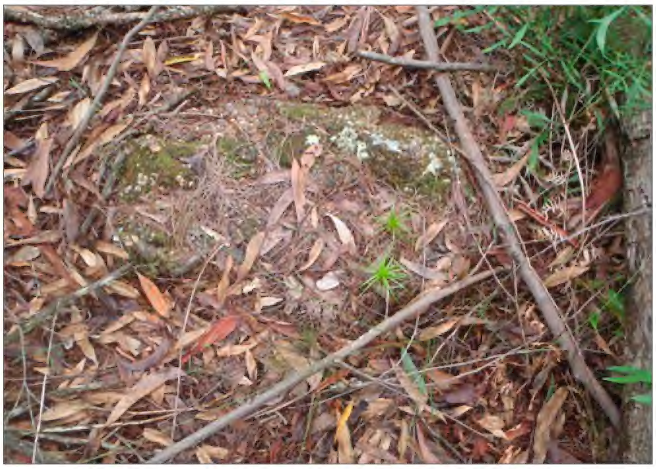

Figure 5. Embedded conglomerate boulder being colonised by *Dracophyllum macranthum* (two small plants at right). Photo: Stephen Bell

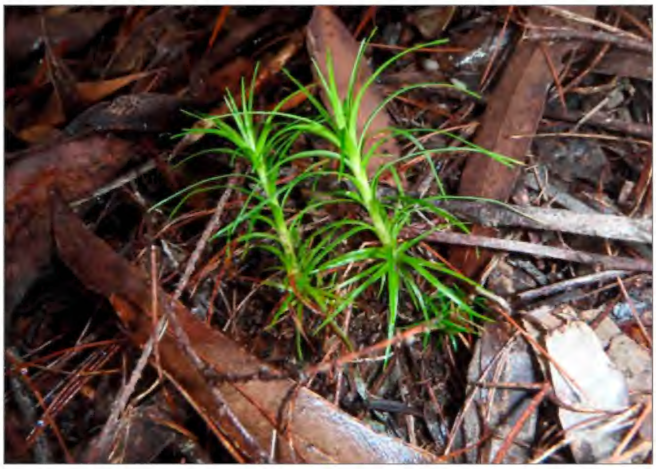

Figure 6. Juvenile *Dracophyllum macranthum* plant, growing on litter covered conglomerate rock. Photo: Stephen Bell

Population size

In May 2018, targeted searches for *Dracophyllum* were conducted within the adjoining Newbys and Starrs Creek catchments of Coorabakh NP. These searches focused on areas where visible cliff lines and conglomerate boulders occurred, outside of the denser rainforest and forest vegetation. Where *Dracophyllum* was encountered, point locations were recorded and an estimate of the number of individuals made. Estimating population size of this species is exceedingly difficult due to the density in which the plants can occur and the steep cliff line habitat. For an overall calculation of population size, an estimate of plants in the 10s, 100s or 1000s was made at each recorded point. Regular points were made in those areas where continuous stands of *Dracophyllum* were present, but numbers estimated were based on those visible only from that point. In most circumstances the recorded numbers would have under-estimated population size, given the difficulty of visually inspecting rock faces above the observation point.

In total, 102 new data points were collected within the two targeted catchments, along approximately 8 km of creekline and associated lower slopes. Fifty-one percent of these comprised stands of *Dracophyllum* in their 100s and 5% were in their 1000s. Although not directly counted it was estimated that at least 30% of observed plants were mature, based on observations that individuals as small as 15 cm high showed evidence of past flowering. From this data the minimum and maximum estimates of total population size within our search areas were made, using lower and upper limits of 10 and 90 (10s data category), 100 and 900 (100s data category), and 1000 and 5000 (1000s data category). This resulted in an estimated population size of between 10,650 and 75,850 individuals. Given that our search areas represented only around 10% of the likely habitat within Coorabakh NP, together with additional but unknown habitat in the adjoining Comboyne SF (where there are 52 existing point records, many along forestry trails), a total population size of well over 100,000 plants could be possible.

Threat assessment

All newly collected data points from Coorabakh NP were amalgamated with a cleaned dataset of records from the NSW Office of Environment and Heritage Atlas and the Australian Virtual Herbarium collection database. The Geospatial Conservation Assessment Tool (GeoCAT)[2] was used to calculate the Extent of Occurrence (EOO) and Area of Occupancy (AOO) following IUCN Guidelines (IUCN 2017). This resulted in an EOO of 14.6 km^2 and an AOO of 36 km^2, potentially qualifying *Dracophyllum* for critically endangered and endangered status respectively, but contingent on other assessment factors. As recommended by IUCN (2017) for situations where EOO is smaller than AOO, the metric for EOO is altered to that of AOO (i.e., EOO is also 36 km^2) to ensure consistency with the definition of AOO as an area within EOO.

We observed very few threats throughout our field surveys for this species. The vast majority of plants occur away from the existing trail network in remote gorges and steep hillsides on cliff lines and rocky outcrops. Consequently, the threats of weed invasion by species such as Crofton Weed (*Ageratina adenophora*) and Lantana (*Lantana camara*) are very minimal and restricted to roadside stands of *Dracophyllum*. Similarly, the potential threat of the soil borne pathogen *Phytophthora cinnamomi*, already known to be present within Coorabakh NP but with no record of infection in this species, is unlikely to be prolific in the remote cliff lined habitat supporting little or no soil. *Eucalyptus pilularis*, the dominant canopy species in the surrounding matrix of open forest, is reportedly susceptible to *Phytophthora* (Podger and Batini 1971; Pratt and Heather 1973; Halsall and Williams 1984), and if it takes hold in this species then changes to micro-habitat supporting *Dracophyllum* may be inevitable. However, evidence to date suggests only a minimal threat to stands of *Eucalyptus pilularis* given its low susceptibility (O'Gara *et al.* 2005; Keith *et al.* 2012). Threats posed through management of existing trails also present only minimal impact to the overall population of *Dracophyllum* and are insignificant in the context of the wider population.

Using this new information on population size and distribution, a revised assessment against IUCN guidelines failed to qualify *Dracophyllum* for any threat category (Table 1). The existing threat status of vulnerable (based on <10,000 mature individuals and a very highly restricted distribution) is consequently no longer applicable for *Dracophyllum*.

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[2] http://geocat.kew.org

Table 1. Summary of threat assessment for *Dracophyllum macranthum*.

Criterion	As applied to *Dracophyllum macranthum*
A: Population size reduction	There is no data (over 10 years or 3 generations) to examine reduction in population size
B: Geographical range	Within threshold for CR on EOO (< 100 km^2) and EN (< 500 km^2) on AOO, but none of the three sub-conditions apply (not severely fragmented with < 10 locations; no continuing decline; no extreme fluctuations in EOO, AOO, number of locations or mature individuals)
C: Small population size and decline	Number of mature individuals well over 10,000 (30% of the observed population were estimated to be mature, meaning > 30,000 mature plants which exceeds the threshold for VU)
D: Very small or restricted population	Well above the 1000 mature individuals threshold (as detailed above), and AOO and number of locations exceeds the threshold for VU (<20 km^2; ≤ 5 locations)
E: Quantitative analysis	No data available

Key: CR = Critically endangered; EN = Endangered;
VU = Vulnerable; EOO = Extent of Occurrence;
AOO = Area of Occupancy

Conclusions

The targeted surveys identified as an important action under the SoS program for *Dracophyllum macranthum* have clearly provided significant results in the management of this and, by extension, other threatened plant species. In the first year of the management program, the futility of establishing monitoring plots for a species that is prolific on conglomerate cliff lines and boulders was offset by the observation that large populations were likely in many of the gorges in Coorabakh NP. A focus-shift away from monitoring individual plants and towards targeted surveys in remote locations has resulted in a considerably larger estimate of total population size than what was originally thought. The extent of our targeted searches covered barely 10% of the expected habitat of this species within Coorabakh NP and, together with unknown habitat extent in the adjacent Comboyne SF, suggests extensive populations of *Dracophyllum* are present across these two tenures. Our estimate of at least 100,000 plants within Coorabakh NP is likely to be conservative in light of predicted unsearched habitat, and a switch in SoS management stream from *site managed* to *keep watch* is undoubtedly justified. Further, the revised assessment of threat status based on these new data suggest possible de-listing of *Dracophyllum macranthum* from the BC Act, enabling available resources to be redirected to other species under greater threat.

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Acknowledgements

Thanks to Ian Turner (NPWS) for local knowledge and support, and Peter Richards for some additional records. Funding for the work reported here was made available through the NSW Government's *Saving our Species Program*, (http://www.environment.nsw.gov.au/savingourspecies/about.htm).

Saltmarsh recolonisation at the Western Treatment Plant, Victoria

FIONA SUTTON[1*] AND MATTHEW DELL[1]

[1] Ecology Australia Pty Ltd, Fairfield, Victoria
* Email: fsutton@ecologyaustralia.com.au

Introduction

In May 2016, Melbourne Water undertook construction works to carefully disassemble the former treatment ponds at the Western Treatment Plant, Werribee, Victoria, now referred to as the 'Restored Saltmarsh 2016' pond. The goal of this was to reinstate the natural tidal regime to restore the Vulnerable ecological community *Subtropical and Temperate Coastal Saltmarsh* and foraging habitat for the Critically Endangered Orange-bellied Parrot (*Neophema chrysogaster)*, with both listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Ecology Australia was commissioned by Melbourne Water to monitor the restoration. It was hypothesised that the vegetation would transition to saltmarsh dominated by species typical of the adjoining Wet Saltmarsh Herbland and Wet Saltmarsh Shrubland Ecological Vegetation Classes (Victorian Saltmarsh Study 2011).

In addition to monitoring within the pond, two locations on the seaward side of the pond wall were also monitored for vegetation changes. At these locations, prior to the pond being decommissioned, freshwater had leaked into the saltmarsh in The Spit Nature Conservation Reserve (The Spit) causing a clearly visible change in the composition of the community.

Methods

Quadrat sampling

Vegetation monitoring was undertaken within 20 quadrats (each 10 x 10 m) in December 2016, May 2017, November 2017 and March 2018: 17 in the Restored Saltmarsh 2016 pond (Quadrats 1–17), and three in the two freshwater incursion points (Quadrats 18–20). Quadrat locations were selected to include a range of environments present within the study area (e.g., permanently to infrequently inundated sites) and with consideration to the scale and extent of observed modification to the vegetation.

Photo points were taken for each quadrat and a visually-assessed cover/abundance value was recorded for each plant species observed, bare ground, water, algae and organic litter. The Domin-Krajina cover/abundance scale (Mueller-Dombois and Ellenberg 1974) was used:

+	< 1% cover, solitary, with insignificant cover
1	< 1% cover, seldom, with insignificant cover
2	< 1% cover, very scattered, with small cover
3	1–5% cover, scattered
4	5–10% cover
5	10–25% cover
6	25–33% cover
7	33–50% cover
8	50–75% cover
9	75– < 100% cover
10	100% cover

Data analysis

A PERMANOVA (Clarke and Gorley 2015) was used to test differences in plant composition between years. SIMPER analysis (Clarke and Gorley 2015) was used to identify flora species which contribute the most to between year compositional dissimilarity. The relationship for sample time against cover-abundance scores of four high contributing species was determined with Generalised Additive Models (GAMs) in R v. 3.5.0 (R Core Team 2013) using ggplot (Wickham 2016). The species were Salt Club-sedge (*Bolboschoenus caldwellii*) (n=15), Red-stem Goosefoot (*Chenopodium macrospermum*) (n=10), Beaded Glasswort (*Salicornia quinqueflora* subsp. *quinqueflora*) (n=16) and Austral Seablite (*Suaeda australis*) (n=15). Of these, Beaded Glasswort and Austral Seablite are typical saltmarsh species, while Salt Club-sedge is better adapted to brackish conditions and Red-stem Goosefoot is an early colonising weed.

Results and discussion

In total, 17 vascular plant species were recorded of which nine are indigenous and eight are exotic. Despite the high number of weed species, their combined cover was comparatively low.

Restored Saltmarsh 2016 pond

A significant shift in species composition of the vegetation has been observed between sample times (pseudo $F_{1,3} = 7.51$, $p = 0.001$). Species characteristic of Coastal Saltmarsh have established and expanded across a large portion of the Restored Saltmarsh 2016 pond (Figure 1). The dominant saltmarsh species—Austral Seablite and Beaded Glasswort —have increased in cover and abundance across the pond, while the early colonising weed Red-stem Goosefoot and less salt-tolerant Salt Club-sedge have become less abundant (Figure 2). Salt Club-sedge remains healthy around the perimeter of the pond where the topography is slightly elevated resulting in less tidal inundation and increased freshwater as run-off during/after rain events.

Filamentous algae were abundant likely in response to the high nutrient levels from remnant biosolids, and showed slight seasonal fluctuations, being highest during the spring surveys compared to autumn surveys.

Although the cover-abundance of algae showed only minor changes over the duration of sampling, anecdotally the mass of algae had reduced somewhat since changes to the pond modification.

Freshwater incursion at The Spit

Saltmarsh vegetation is successfully recolonising the two points of freshwater incursion in The Spit (Figure 3) where previously fans of Salt Club-sedge had outcompeted the saltmarsh vegetation that prefers more saline conditions. Since the freshwater source was removed in November/December 2015, Salt Club-sedge has reduced from being dominant to now 1–5% cover in Quadrat 18, and less than 1% cover in Quadrats 19 and 20, most of which appears to be dead or very unhealthy. Austral Seablite dominated two of the three quadrats transforming the vegetation back to saltmarsh, while the annual weed Hastate Orache (*Atriplex prostrata*) was most abundant at the third quadrat. Filamentous algae appeared to be absent from the three quadrats in The Spit over the course of monitoring.

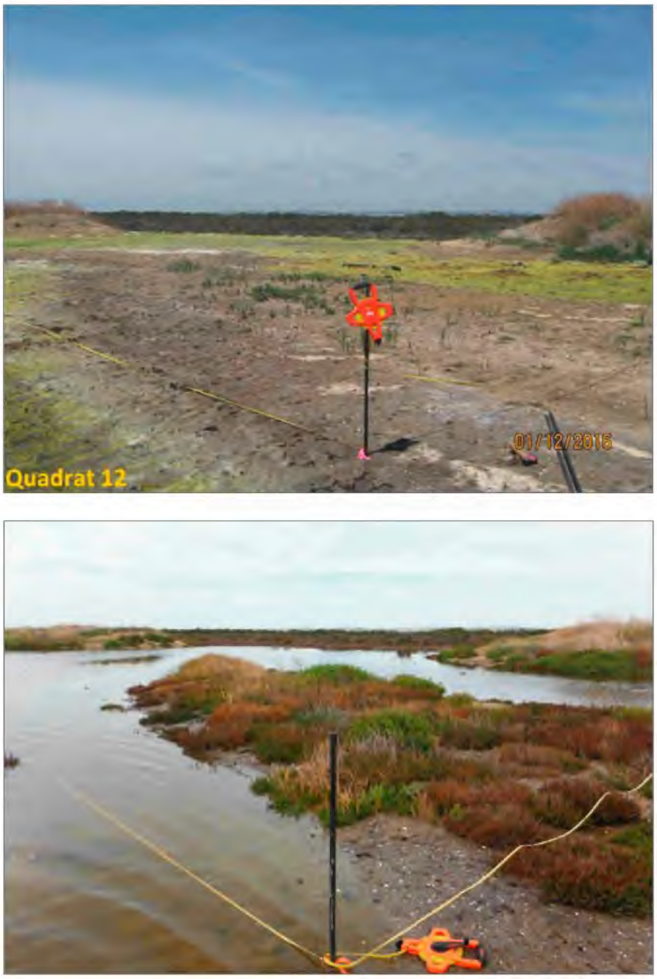

Figure 1. Saltmarsh vegetation successfully recolonising suitable niches at Quadrat 12 in the Restored Saltmarsh 2016 pond. Photo top: John Kershaw, December 2016; bottom: Leigh Kett, March 2018

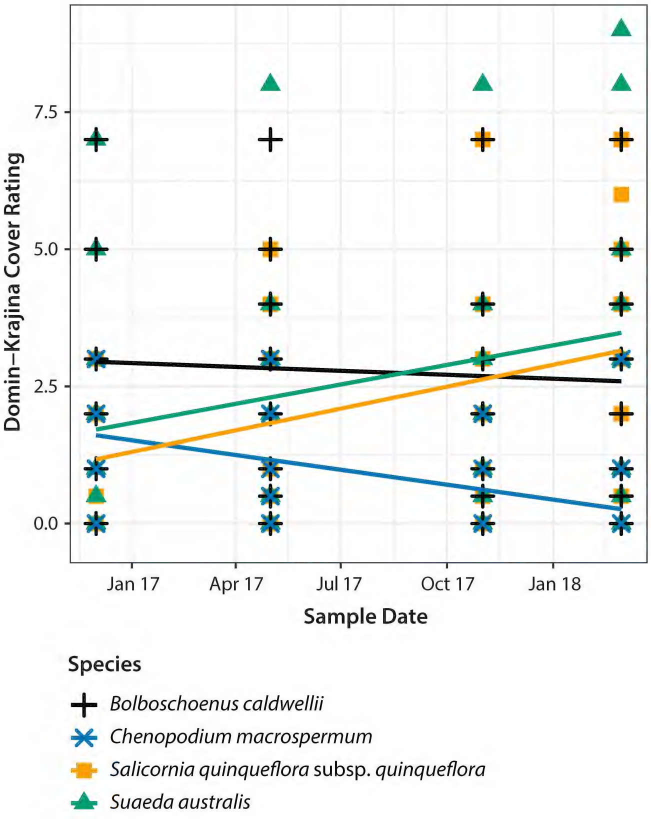

Figure 2. Modelled relationship and confidence intervals for survey date against mean cover score for *Bolboschoenus caldwellii* Salt Club-sedge (n=15), ****Chenopodium macrospermum* **Red-stem Goosefoot (n=10), ***Salicornia quinqueflora*** **subsp.** ***quinqueflora*** **Beaded Glasswort (n=16) and** ***Suaeda australis*** **Austral Seablite (n=15).**

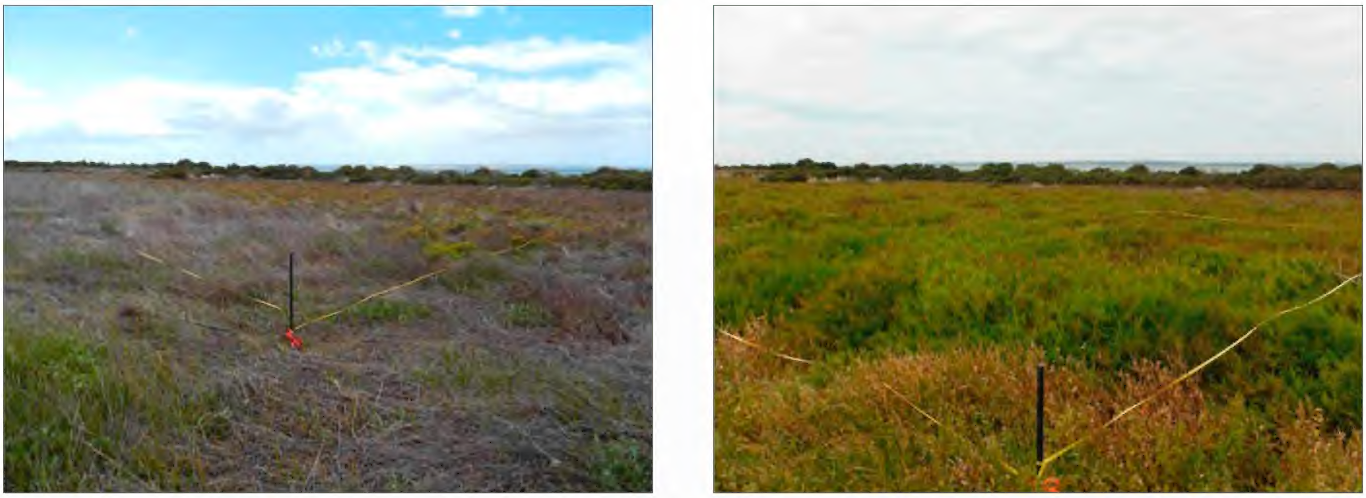

Figure 3. Rehabilitation monitoring of a freshwater incursion point showing *Bolboschoenus caldwellii* dieback and *Suaeda australis* recolonisation at Quadrat 19 in The Spit. Photo left: Ruby Albury, December 2016; right: Leigh Kett, March 2018

Conclusions

Melbourne Water's primary objective of the project was to increase the extent of EPBC Act listed *Subtropical and Temperate Coastal Saltmarsh vegetation* and Orange-bellied Parrot habitat at the Western Treatment Plant. The simple act of returning a more natural topography and tidal regime to the former treatment pond (which adjoins areas of remnant saltmarsh in The Spit) has successfully re-established coastal saltmarsh vegetation without the need for revegetation or much ongoing financial investment. This project builds upon other saltmarsh restoration work and monitoring completed at the site in the past eight years.

Within The Spit, saltmarsh vegetation has successfully recolonised where Salt Club-sedge has died back, and this positive outcome is anticipated to continue over time. In some locations, the abundance of the weed Hastate Orache has reduced, though based on results to date it is anticipated that this weed will be replaced with typical native saltmarsh species over the coming few years.

Acknowledgments

Ecology Australia gratefully acknowledges Melbourne Water Corporation for commissioning the project, and their staff members Heather Graham, William Steele and Kevin Gillett. Many thanks also to Ruby Albury from Wildlife Experiences and John Kershaw, Leigh Kett, Matt Le Feuvre and Lucy Gow from Ecology Australia.

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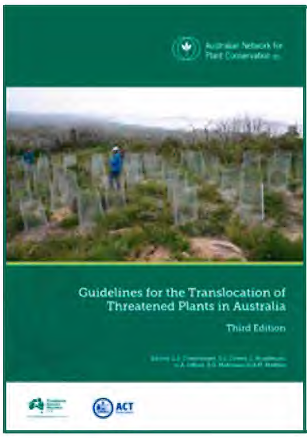
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Email: lukas.clews@jacobs.com

Introduction

Threatened plant conservation involves activities which aim to prevent plant species from becoming extinct. These activities typically include the direct conservation of wild populations, invasive species control, collections of plants within botanic gardens, and education and research programs. Plant conservation can also involve ecological consultants working on development projects. In New South Wales there are over 600 threatened species of plant listed under the *Biodiversity Conservation Act 2016* (BC Act) and there is widespread recognition that we can no longer afford to eliminate species to make way for human development. Conservation is now an important goal of planning and development, and Environmental Impact Assessment (EIA) procedures are embedded in the decision-making processes for infrastructure projects.

One of the specialist sub-disciplines of EIA, aims to identify, predict and evaluate the impacts of developments on threatened species. This EIA procedure is where one opportunitiy lies for ecological consultants to contribute to threatened plant conservation. While the approach to threatened species-centric EIA has been criticised, it is the listing of threatened biodiversity under legislation that is the critical driver for EIA, and consequently the conservation of species at a development site.

I work for one of the largest providers of technical, professional and construction services, including engineering, construction, and scientific consulting. As an ecologist, my role is specifically to deliver EIAs. On a daily basis I am involved in a range of large infrastructure projects. This level of hands-on involvement with development places ecological consultants in a unique position to directly influence the conservation of threatened plants.

Planning and opportunities for Plant Conservation

Every infrastructure project goes from initial planning and concept design, to construction and completion. The initial planning and design phase is the first stage where ecological consultants can have an influence on threatened plant conservation. During the planning phase several options are considered for the siting of a piece of infrastructure. Becoming involved at this early stage, an ecologist has the opportunity to be proactive and select the most appropriate site in terms of successful outcomes for threatened plants and the piece of infrastructure in question.

Once a suitable site is chosen, the EIA is undertaken based on an infrastructure design that is preliminary and incomplete. This provides an opportunity for ecological consultants to work closely with engineers and be proactive in the design phase. If a thorough threatened species survey is undertaken and threatened plants are discovered and mapped in detail, there is often broad scope to redesign the project to avoid the locations of threatened plants. This can lead to conservation of threatened plants on the site while allowing for a piece of infrastructure to be developed. On a recent infrastructure project in the NSW Brigalow Belt region we were able to influence the design of a project so that a potentially significant impact to the threatened grass species Belson's Panic (*Homopholis belsonii*) was avoided.

However, there are often instances where detailed design cannot avoid a significant impact to a threatened plant due to social or economic reasons. When an impact to a threatened plant has been avoided or minimised to the greatest extent possible, the BC Act outlines a framework to offset impacts through the Biodiversity Offsets Scheme. Through the development of Biodiversity Stewardship Sites (which are voluntary in-perpetuity agreements entered into by landholders), species credits for threatened plant species can be generated which are used to offset impacts on threatened species. While this is used as a last resort after avoidance and minimisation measures have been considered, it does provide for in-perpetuity conservation. Whilst not ideal, we have seen positive outcomes via this pathway at a number of offset sites in northern NSW which have resulted in positive outcomes for a number of threatened plants including the Square-fruited Ironbark (*Eucalyptus tetrapleura*) and Hairy Melichrus (*Melichrus* sp.) in Newfoundland State Forest (see Figure 1a and 1b).

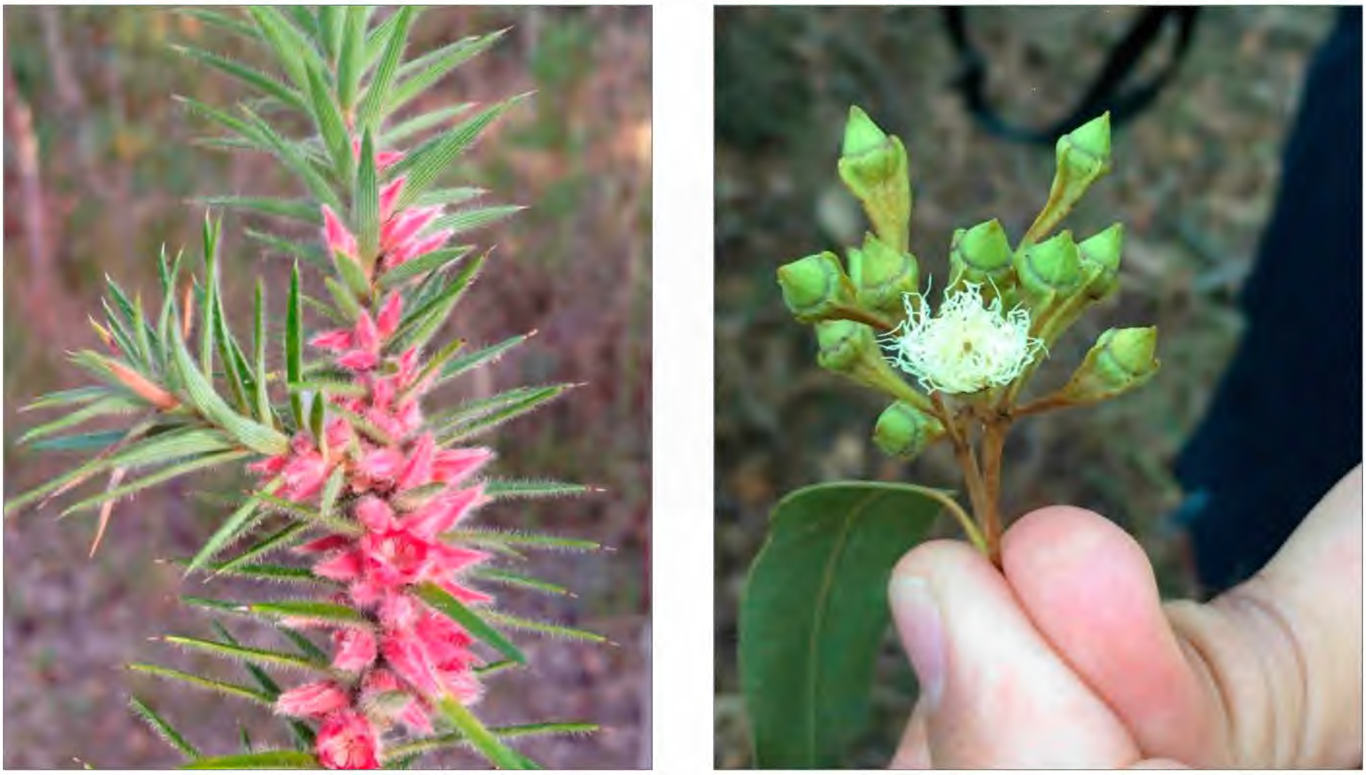

Figure 1a and 1b: Offset sites in northern NSW have been established that conserve in-perpetuity threatened plant species including *Melichrus* sp. Newfoundland State Forest and *Eucalyptus tetrapleura* that have locally restricted distributions. Photos: Paul Rossington

The final phase where ecological consultants can contribute greatly to threatened plant conservation is during the construction process. Before construction begins ecological consultants often undertake pre-clearing surveys to identify the exact location of threatened species on a development site. This information is used to inform the final design of infrastructure and influence micrositing of project components. The locations of threatened species are marked on maps and in the field, and advice regarding the location of exclusion zones is provided (see Figure 2). Often, the entire extent of a development site does not need to be cleared for a project to proceed and potential impacts identified at the EIA stage can be avoided. Even at this late stage a piece of infrastructure can be redesigned slightly and the clearing area reduced in strategic locations to avoid removing threatened plant species. On a recent project in the NSW South Eastern Highlands we were able to restrict clearing in portions of a construction corridor to avoid impacts to saplings of the threatened Capertee Stringybark (*Eucalyptus cannonii*) that were not identified in the EIA. This led to a mutually beneficial situation for conservation of threatened plants and the project as all regulatory measures could be met.

Issues and limitations

Central to the practice of EIA is being able to identify threatened species. Consultants undertaking surveys must have sufficient applied plant taxonomy, identification and field skills. It is essential that the ecological consultant is able to identify plant families using morphological characteristics and be able to transfer identification principles to any taxonomic group in the field. Otherwise, there is a real risk of misidentification of plant species which can lead to perverse outcomes for threatened plant conservation and the development. If a potential threatened species is located, a specimen should always be collected and submitted for confirmation of identification at an institute such as the Royal Botanic Garden Sydney.

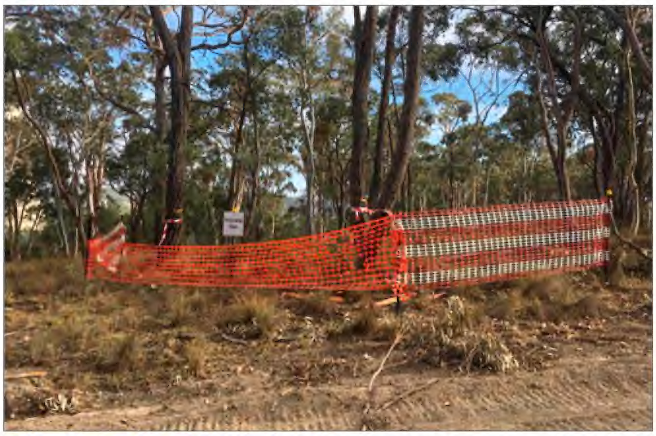

Figure 2: Erecting exclusion zones around threatened plants enables physical protection on development sites. Here *Eucalyptus cannonii* trees have been protected by high visibility fencing and exclusion zone signage to designate a no-go area. Photo: Lukas Clews

There are many instances where misidentification of species has led to some close calls for threatened species. An example I experienced on a construction site recently was where a consultant had identified the threatened species *Veronica blakelyi* in the construction corridor. Upon inspection during the pre-clearing surveys this plant was found to be the more common *Veronica derwentiana* subsp. *subglauca*. Conversely, the presence of the threatened species Capertee Stringybark and Black Gum (*Eucalyptus aggregata*) was not identified but these species were present in some numbers in the construction corridor. This could have led to detrimental outcomes for biodiversity and the project if a detailed pre-clearing survey had not been undertaken as part of the construction phase. In this case we were able to redesign portions of the project and implement low impact construction methodologies to conserve these species on site.

Conclusions

Threatened plant conservation can be improved when threatened species conservation measures are actively included in all stages of development including planning, design and construction of infrastructure. The development of infrastructure and the conservation of threatened plants are not mutually exclusive and ecological consultants can and do play an important role in threatened plant conservation. However, for this to be successful, consultants need to be skilled and experienced, and proactively involved through all project phases.

News from the Australian Seed Bank Partnership

Note from ASBP: In this issue of APC, the News from the ASBP focuses on a pilot project the ASBP delivered earlier this year that involved capacity building for Indigenous traditional owners at Kakadu National Park and international scientists from Papua New Guinea and West Papua. The project was a collaboration between ASBP and the Australian Grains Genebank and is hopefully the first of many crop wild relative projects that the collaboration can continue to deliver over the coming years.

Crop wild relatives seed conservation at Kakadu National Park

DAMIAN WRIGLEY[1], SALLY NORTON[2], TOM NORTH[3] AND BEN WIRF[4]
1 Australian Seed Bank Partnership; Australian National Botanic Gardens, Clunies Ross Street, Acton, ACT, 2601
2 Australian Grains Genebank; Department of Economic Development, Jobs, Transport and Resources; Private Bag 260, Horsham, Victoria 3401
3 Australian National Botanic Gardens; Clunies Ross Street, Acton, ACT, 2601
4 George Brown Darwin Botanic Gardens; Department of Tourism and Culture, GPO Box 1448, Darwin, NT, 0801

Crop wild relatives

Crop wild relatives (CWR) are wild plant species that are genetically related to crops, but have not been domesticated. They can be defined as 'a wild plant taxon that has an indirect use derived from its relatively close genetic relationship to a crop' (Maxted *et al*. 2006). They occur in many habitats throughout the world and in Australia include species of *Ipomoea* (sweet potato), *Cajanus* (pigeon pea), *Glycine* (soybean), *Musa* (banana), *Oryza* (rice), *Sorghum* (sorghum), Solanum (eggplant) and *Vigna* (mungbean, cowpea).

In 2011 the Global Crop Diversity Trust (the Trust) launched the *Adapting agriculture to climate change: collecting, protecting and preparing crop wild relatives project* (Dempewolf *et al*. 2014). As part of this project an international gap analysis identified global priority species for *ex situ* conservation, including those that are most endangered. The Trust, in collaboration with the Royal Botanic Gardens, Kew identified 40 target species for collection in Australia. The Australian Seed Bank Partnership (ASBP) and the Australian Grains Genebank (AGG) recently delivered a project that secured 15 new seed collections from *Cajanus, Glycine, Oryza, Sorghum* and *Vigna* species as part of the global crop wild relative conservation effort.

Seed Conservation Techniques

In late April 2018, Dr Sally Norton and Dr Katherine Whitehouse from the Australian Grains Genebank (AGG), Tom North from the Australian National Botanic Gardens and Ben Wirf from the George Brown Darwin Botanic Gardens spent a week at Kakadu National Park in the Northern Territory collecting seed and sharing their knowledge about seed conservation. Project participants included Kakadu National Park traditional owners, staff and school-based trainees with a focus on women rangers, as well as visiting scientists from Indonesia and Papua New Guinea. The participants were provided with field-based training in the identification, collection and storage considerations for crop wild relative species. Kakadu Rangers and traditional owners also shared their knowledge of the traditional management of Sorghum found within the National Park.

The training covered aspects of plant identification and seed collection, as well as techniques for cleaning, drying and storing seed. The project team used a modified version of the Millennium Seed Bank's seed conservation drum kit to ensure collections arrive at seed banks across Australia and the UK in the best possible condition. It is hoped that the seed conservation techniques taught at Kakadu this year will support long-term plant conservation throughout Australasia.

Seed collections

Throughout the week the team travelled south from Jabiru to the Mary River region and managed to collect seed from *Cajanus, Galactia, Glycine, Oryza, Sorghum* and *Vigna* species. Following the field elements of the training, the international participants accompanied the seed collections back to the AGG in Horsham, Victoria where they received intensive lab-based training in the ways to process crop wild relative seeds for long term storage. Once the collections have been cleaned and dried, duplicates will be sent to the National Seed Bank at the ANBG, the Seed Bank at the GBDBG and the Millennium Seed Bank, Kew in the UK, for long-term *ex situ* conservation and research.

Access and Benefit Sharing

Access and benefit sharing arrangements are important considerations for this project as Kakadu is jointly managed by the Australian Government and traditional owners. Any potential research for the commercialisation of genetic material from seed collected from Kakadu will require approval under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* as well as the support of relevant Traditional Owners and the Kakadu Board of Management. Additionally, Part 8A of the Environment Protection and Biodiversity Conservation Regulations (2000) control the access to biological/genetic resources in Australia's National Parks via permits. These Regulations give effect to the third objective of the Convention on Biological Diversity—the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.

Searching for pigeon pea in Kakadu National Park.
Photo: Australian Grains Genebank

Learning to use a seed conservation drum kit: L-R Jenny Hunter (TO), Jacqueline Cahill (Ranger), Ben Wirf (trainer), Chantelle Bayne (school based apprentice).
Photo: Australian Grains Genebank

Jimmy Frans Wanma, Katherine Whitehouse, Sally Norton, Ben Wirf, Tom North and Gibson Sosanika ready to collect crop wild relatives in Kakadu National Park.
Photo: Australian Grains Genebank

The regulations also ensure that Australia's genetic resources are used for research and development on mutually agreed terms, with prior informed consent and an equitable return to Australia, while ensuring the environment is protected. It is essential that future crop wild relatives collecting in Australia be supported by meaningful access and benefit sharing arrangements that ensure the benefits of commercialising genetic material flow back to the communities from whose country seed is collected.

Acknowledgements

The MSBP and the Crop Trust supported this project with funding from the Government of Norway and the Herbert Simon Foundation. Further lab-based training at the AGG was supported by the Crawford Fund. The field component of this research was conducted in Kakadu National Park under Permit No. RK915. The ASBP and AGG wish to thank the Kakadu Traditional Owners for supporting us to deliver this project on country, and to former and current staff at Parks Australia for their support in delivering this project, particularly Anthony Simms, Matthew Quinn, Rachel Price, Shiona Macdonald, Margarita Goumas and Brad Desmond.

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ANPC member profile

Rachel Musgrave

What is your current position?

Team Leader of the NSW Ecology Team at SMEC.

What projects are you working on at the moment?

A variety of large and small scale developments, including major infrastructure projects. I'm also working on a few short term monitoring projects for endangered ecological communities and threatened species.

How did you end up working in plant conservation?

My first ecology job out of university was as a bush regenerator. When I started I wasn't able to identify Lantana, so it was a rather steep learning curve for the first couple of years. Thankfully I had some knowledgeable colleagues and soon began to appreciate the detail and complexity of plants. As I avoided botany subjects at university I never would have guessed that one day I would consider myself a botanist!

As a consultant, impact assessment makes up the majority of the work I do. However, I also participate in monitoring projects and prepare management plans. Consequently, I don't see myself as working in a traditional plant conservation role, and I often feel as though I document the loss of biodiversity more than conserve it. Nevertheless, the process of finding threatened flora as part of the development process and ensuring that impacts on these species are considered and acknowledged is important, even if there is little scope in the legislation for their onsite conservation. Convincing clients to alter designs to avoid impacting areas of conservation significance can also be rewarding.

Returning back to the car after a few days botanising in the Western Arthurs, Tasmania. Photo: Rachel Musgrave

What is your favourite plant and why?

Hard question! *Welwitschia mirabilis* – because it looks like it has been vomited up by a dinosaur.

Why do you think the ANPC network is important and what do you see as our priorities?

Plants tend to be invisible to most people, so to have an organisation dedicated to their conservation is important in bringing attention to the issue of plant related extinction. I see ANPC's priorities as bringing together those working in the plant conservation field to share knowledge and experiences, and to advocate for science-based conservation measures.

Regional botanic gardens profile

Orange Botanic Garden

Orange, in the Central West region of New South Wales, is known for its cool climate. The city is at 863 m elevation, and sits at the foot of Mt Canobolas (1,392 m). The Orange Botanic Garden, established in 1981, covers 17 hectares and is managed by Orange City Council. Like many regional botanic gardens, it has both native and exotic plantings. According to Gardens Manager, Neil Bollinger, the emphasis on native plants has increased over the last 20 years, with greater recognition of the remnant woodlands that the gardens incorporates, as well as plantings to reflect the local flora. Recently there has been a push to develop the long-planned Canobolas Garden, with a focus on the unique species and vegetation communities of Mt Canobolas. In some ways, the evolution of the garden reflects the local geology, such as the basalt rock garden beds being a representation of the areas volcanic history.

Mt Canobolas, formed as a result of volcanic activity during the Tertiary, is one of the highest points in Australia west of the Great Dividing Range. Mt Canobolas is home to a range of notable species, including the eponymous Silver-leaf Candlebark *Eucalyptus canobolensis*, listed as Endangered in NSW, and *Prostanthera gilesii*, which was recognised as Critically Endangered in NSW in December 2017. This is in addition to two endangered communities, the *Xanthoparmelia* lichen community and Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland community.

Like many regional botanic gardens, Orange Botanic Garden works with scarce resources. The Friends of Orange Botanic Garden (FOBG) are a dedicated group who volunteer their time and skills in gardening and propagating native and exotic plants, to keep the garden at its best. FOBG member, Dennis Croucher, was happy about the marble slab that had been laid for the Canobolas garden, and is keen to help with propagation of local plants. FOBG also contributes to awareness raising about local biodiversity by running monthly bird walks in the gardens, on which the beautiful and nationally Vulnerable Superb Parrot can be seen.

Another highlight of the Orange Botanic Garden is the bush regeneration area, which is a demonstration of what happens when nature is left to take its course. This was an initiative of Neil's when he joined the gardens 22 years ago, and this beautiful grove of *Eucalyptus melliodora* and *Eucalyptus viminalis*, once dominated by the weed Phalaris, now includes native grasses (*Rytidosperma*), daisies and eucalypt recruits in the understory. This 'work in progress' woodland will continue to change, grow and improve over time. Nearby the bush regeneration area is a gorgeous – and awareness raising – display of native grasses.

Bush regeneration area with Yellow Box (*Eucalyptus melliodora*) and Ribbon Gum (*E. viminalis*). Photo: Heidi Zimmer

Basalt rocks in Canobolas Garden. Photo: Heidi Zimmer

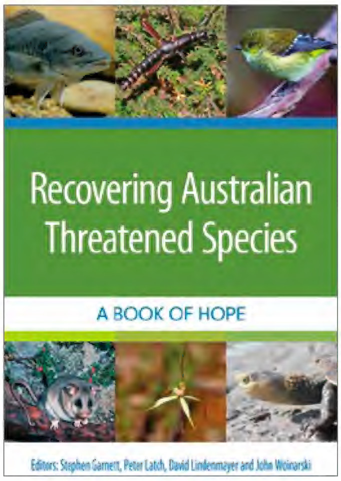
Heidi Zimmer

Editor's note: Approximately 70% of the Mt Canobolas State Conservation Area was burnt in February 2018. The Orange Botanic Garden is playing a key role in recovering some of the mountain's endemic threatened flora.

Book review

Recovering Australian Threatened Species – A Book of Hope

Editors: Stephen Garnett, Peter Latch, David Lindenmayer and John Woinarski
Paperback | March 2018 | $ 59.95 | ISBN: 9781486307418 | 360 pages | 245 x 170 mm | Publisher: CSIRO Publishing


Recovering Australian Threatened Species
A BOOK OF HOPE
Editors: Stephen Garnett, Peter Latch, David Lindenmayer and John Woinarski

This book is a compilation of successful stories about the recovery of threatened species in Australia. It is an injection of optimism about what conservationists and the community can do to conserve our environment, especially threatened species.

Our society is so focused on complaints about what we have not accomplished that we forget to stop for a moment and look around to appreciate where success has been achieved. By acknowledging and sharing stories of successful recoveries, we can learn more, and identify the methods and activities key to continuing the exhausting but wonderful and important work of threatened species conservation in Australia and worldwide.

This book does not include many plant species stories, but it does cover a wide range of threatened species archiving a panorama of important issues encountered in threatened species recoveries – many of which could be controlled.

The structure of the book involves individual case studies, each includes a summary of the problem, actions taken, the indicators of, and the reasons for success. This structure allows the reader to compare each case study and identify the key ingredients for threatened species recovery.

From my understanding, what is required is long-term, consistent and coordinated management. Key elements for success in the recovery of the species are: government accountability through continuous funding; agency planning and policy, including recovery plans, as well as national and international agreements; community engagement to connect people to their environment and thus protect it; research into species biology, ecology and threats to inform management; and consistent monitoring.

The following case studies provide good evidence for what coordinated, committed and assertive management can do for the recover a species:

- Humpback whale – an international agreement for ongoing protection, robust monitoring and changing the community attitudes about hunting whales.
- Macquarie Island – restoring its natural ecosystem after pest animal impacts on the native species of plants and animals.
- Mary's Famous Five – a multispecies and river system approach to recovering threatened aquatic species over community engagement, habitat restoration, and protection of key species through a long (20 years), consistent and coordinated recovery effort.
- Spiny rice-flower – threatened by habitat clearing fragmentation and invasion of weeds. Research on species biology and ecology, and education of land managers and the community has led to its recovery.
- Noisy scrub-birds and Western ground parrots – species confined to a very small area of fire-prone habitat with a threat of introduced predators. Recovery resulting from research on habitat requirements, reduction of fire risk and control of foxes and feral cats, as well as community commitment.
- Spiny daisy – a species confined to only six degraded populations, with low genetic diversity, and a lack of ecological knowledge. Success through weed control, translocation of plants and community involvement.

A book to keep as a positive reminder of the great effort many have undertaken to conserve the beauty of our species.

Eren Delgado

News

Cuttings: Plant news from around Australia

Concerned about the effect of feral horses in Kosciuszko National Park? Here's how you can help

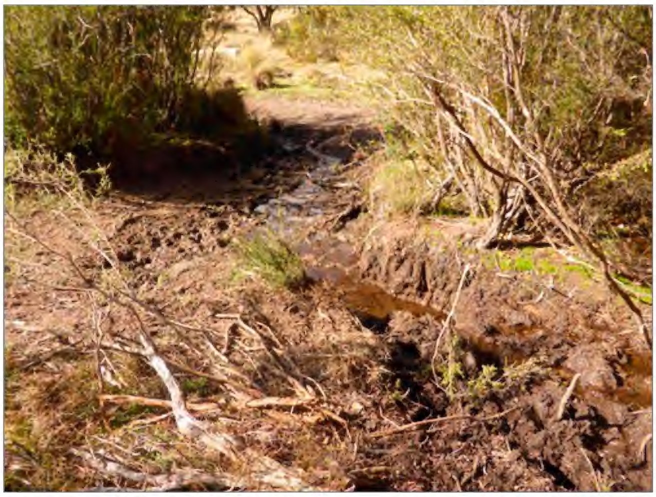
In June, the NSW Parliament passed the Kosciuszko Wild Horse Heritage Act 2018, which sets a disturbing precedent by giving an introduced species greater protection than native animals in Kosciuszko National Park. In response, a number of bushwalkers have set up Save Kosci Inc (www.savekosci.org), to maintain an evidence-based web site on wild horse damage to ecosystems in the Kosciuszko area, and to run a protest walk from Sydney to the summit of Kosciuszko.

We are seeking volunteers with science backgrounds to compile summaries of evidence that a species present in Kosciuszko National Park is threatened by feral horses. We are looking for summaries that are 300 to 400 words, readable but fully referenced. We are hoping each writer might undertake to cover one or two species. We are also looking for photos of threatened species that have permissions for distribution to the media.

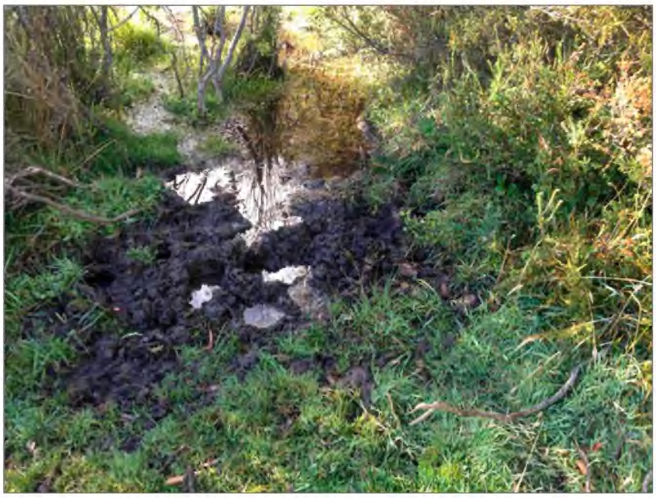
We are hoping that ANPC, either as an organisation or through individual members, might support Save Kosci in this way. We would also welcome ANPC members who are interested in participating in the protest walk.

The new website for the walk is now running: www.savekosci.org, with a supporter registration form. If your members are interested, we'd be grateful if they could use that form to register as individual. They should include any science background and interests in one of the form's text boxes. Registration costs $12. Inquiries welcome – to convenor@savekosci.org

Linda Groom, Convenor, Save Kosci Inc
0473 919 441



Initial stages of feral horse damage to stream-side vegetation near Bill Jones Hut, Cooleman Plains, KNP, March 2014.



The same spot just four years later, May 2018.

Dozens of animals and plants join Australia's threatened species list

What do tingle pygmy trapdoor spiders from Western Australia, silver-headed antechinus from central Queensland and Duramana fingers orchids from NSW have in common? If you're waiting for a funny punchline, sorry – the answer is that they're among the 41 new species of Australian plants and animals that are now officially at risk of extinction. The good news though is that this listing could, potentially, be the first step towards reversing the country's world leading extinction rate. Those 41 species were among 50 changes to the country's official threatened species list after its annual update. As well as the additions, both the Wollemi pine – noted as the botanical find of the century – and the western ringtail possum have deteriorated to become "critically endangered".
https://www.smh.com.au/environment/conservation/dozens-of-animals-and-plants-join-australia-s-threatened-species-list-20180512-p4zexo.html

Olive Pink, activist, artist and environmental saviour, celebrated in new book

In the 1950s, when Australia's gardeners were just getting a taste for coastal tea trees and eucalypts, Olive Pink had already moved on to arid-region species. This gardener, artist and activist was always ahead of her time. Pink grew up surrounded by the cool, green gardens of Tasmania, but she made her name in the desert. In 1956, at the age of 72, she persuaded the Northern Territory government to create a flora reserve on land that had been stripped by goats, rabbits, camels and cattle. The book details how Pink's paintings, like the Alice Springs flora reserve she established, provide "an enduring and botanically valuable record of Australian arid-lands vegetation". Her 1930 painting of the rare *Eremophila prostrata* is, for example, the earliest known record of this species.
https://www.smh.com.au/environment/conservation/dozens-of-animals-and-plants-join-australia-s-threatened-species-list-20180512-p4zexo.html

New app to identify wildflowers

Geraldton and Mid West residents are invited to identify wildflowers with a free new mobile phone application. The "CRFwildflowers" app was developed by Chapman River Friends volunteers Alice James and Virginie Fuhrmann. The free interactive guide features photos and information about 112 species of flora found in the Chapman River Regional Park.
https://thewest.com.au/news/mid-west/new-app-to-identify-wildflowers-ng-b88857962z

Weed threat to Pilbara national parks

A South American invader is threatening the ecology and amenity of the North West's most renowned national parks as existing control methods struggle to halt its aggressive growth. Passiflora, or stinking passionflower, has already overrun the Jirndawarranha Pool's surrounds in Millstream-Chichester National Park, and has been found in low densities near Karijini and in Murujuga National Park. In the Kimberley, blankets up to one metre thick have been found in areas such as Giekie Gorge and it is overtaking freshwater crocodile nesting grounds.
https://thewest.com.au/news/pilbara-news/weed-threat-to-pilbara-national-parks-ng-b88835167z

Myrtle rust – from information to action

Myrtle rust is a new contagious fungal plant disease impacting one of Australia's most important plant families – Myrtaceae. First detected in NSW in 2010, it is highly mobile, can reproduce rapidly and has already infected more than 347 plant species across a broad geographic range. Containment and eradication responses have so far been unsuccessful. A new TSR Hub article describes why this plant disease poses such a threat and what we are doing about it. A TSR Hub project is building on a review and draft action plan for myrtle rust and its impacts undertaken by Bob Makinson and the Plant Biodiversity CRC. Recent surveys in far north Queensland have revealed that myrtle rust is more prevalent and is impacting a larger variety of species than previously thought, including canopy tree species. The rust is particularly threatening for the fleshy-fruited myrtle species in rainforests and for more than 40 range-restricted myrtle species.
http://www.nespthreatenedspecies.edu.au/news/myrtle-rust-is-here

Myrtle rust is here – Threatened Species Recovery Hub

A new contagious fungal plant disease has entered Australia, myrtle rust. It's highly mobile, can reproduce rapidly and is infecting many species across a broad geographic range. Containment and eradication responses have so far been unsuccessful. In short, the risks posed by myrtle rust are a perfect storm for plant species within one of Australia's most important plant families, the Myrtaceae. Jarrah Wills from the Queensland Herbarium describes why this plant disease poses such a threat and what we are doing about it.
http://www.nespthreatenedspecies.edu.au/news/myrtle-rust-is-here

Conservation groups welcome ALP pledge to protect Snowy Mountains from feral horses

Leading conservation groups have welcomed NSW Labor's pledge to protect the state's fragile Snowy Mountains from large herds of ecologically destructive feral horses. The NSW Nature Conservation Council, National Parks Association of NSW, the Invasive Species Council and the Colong Foundation for Wilderness have also welcomed Labor's promise to increase funding for feral animal control and restore funding for the NSW National Parks and Wildlife Service. **https://invasives.org.au/media-releases/conservation-groups-welcome-alp-pledge-to-protect-snowy-mountains-from-feral-horses/**

Debate over Kosciuszko National Park brumby cull as bitter as ever

The image of The Man From Snowy River that featured at the opening of the Sydney Olympics has attracted people from all over the world to Kosciuszko National Park. But academics and environmentalists have long argued sentimental cultural attachments should not be prioritised over the environment of the park, which they say has been badly damaged and has left native species under threat. **https://www.smh.com.au/national/nsw/debate-over-kosciuszko-national-park-brumby-cull-as-bitter-as-ever-20180524-p4zh8o.html**

NSW Brumby Bill makes Australia global laughing stock

The NSW Government turned Australia into a global laughing stock when it passed legislation protecting destructive feral horses in Kosciuszko National Park, locking in the ongoing degradation of sensitive alpine plains and wetlands. "The NSW Government crossed a line last night when it passed legislation to protect destructive feral horses at the expense of one of Australia's most iconic national parks and the threatened species it protects," Invasive Species Council CEO Andrew Cox said. "The decision to let destructive feral horses run free in Kosciuszko National Park means we will see ongoing degradation of precious alpine habitat and threatened species like the critically endangered corroboree frog will be put at greater risk of extinction. "If allowed to stand this decision sets a dangerous precedent for feral animal management in Australia" Cox said. **https://mailchi.mp/invasives/jj75ql9k9c-1261553?e=cfc3e2bfac**

Deficient and doomed to fail: experts roast threatened species plan

The world authority on nature protection has blasted Australia's blueprint to save animals and plants from extinction as "fundamentally deficient" and the federal government's own experts say it is "doomed to failure". The damning feedback comes weeks after 41 new species of animals and plants were added to the official list of those edging towards extinction, further entrenching Australia's record as a world leader in biodiversity loss. **https://www.smh.com.au/politics/federal/deficient-and-doomed-to-fail-experts-roast-threatened-species-plan-20180608-p4zkc3.html**

How a 'most beautiful plant' helped turn the conservationist tide

For Alec Costin, the discovery of a field of anemone buttercups in alpine grasslands near Mount Kosciuszko marked a turning point in that region's conservation. Six decades ago – when the environmental fate of the region was last up for grabs – Dr Costin helped get sheep removed from what was then the Kosciusko State Park. Taking Sir Garfield Barwick – a prominent lawyer and park trustee who favoured extending leases graziers had enjoyed above 1300 metres since the 1920s – on a three-day mountain tour proved Dr Costin's master stroke. Even today, the buttercup remains vulnerable, found only in a 32-by eight-kilometre strip near Guthega. But, back then, its future was precarious as it was a favoured sheep fodder. **https://www.smh.com.au/environment/conservation/how-a-most-beautiful-plant-helped-turn-the-conservationist-tide-20180608-p4zk98.html**

Saving endangered species in the Nambucca Valley

Funding was supplied to the Nambucca Shire Council by the NSW Environmental Trust and the North Coast Local Land Services to reduce the impact of bitou bush and large woody weeds on an endangered population of native legume, the *Glycine clandestina* (broad leaf form) that is only known to grow in the Themeda grass headlands just to the south of Scotts Head village. **https://www.nambuccaguardian.com.au/story/5460591/saving-endangered-local-plant-species/?cs=733**

Improving monitoring and management for Gulf mangroves

Mangroves support biodiversity and fisheries, protect shorelines from coastal erosion and storm damage, and store more carbon than terrestrial forests. As part of a cross-Hub project on assessing mangrove dieback in the Gulf of Carpentaria, the NESP is contributing to Australia's first nationwide mangrove observing system. This now open access dataset is the largest single dedicated acquisition over a mangrove ecosystem anywhere in the world, and provides a vital base for observing change and understanding how this dynamic ecosystem is responding.
http://www.nespnorthern.edu.au/2018/06/21/improving-monitoring-management-for-gulf-mangroves/

The 'pinosaurs' being fire-proofed to last another 200 million years

In a secret valley full of leeches, spiders and angophoras two hours from Sydney, scientists are waiting like anxious parents to welcome the birth of a baby pinosaur or two. Pinosaur is the nickname given by some scientists to the prehistoric and Critically Endangered Wollemi pine. It was thought to be extinct until 100 of these Jurassic era conifers were found in four groves in a dark canyon in the Wollemi National Park 150 km from Sydney. Now an "insurance population" of 191 trees planted six years ago in an undisclosed location – far enough away from the original trees that if fire or predators strikes one lot of trees the other will survive – is producing fertilised seeds for the first time. "The good news is that the Wollemi pines are making babies. Just like me," said Dr Heidi Zimmer, a senior scientist with NSW Environment who is also seven months pregnant. She's tracked the trees' progress since they were planted as juveniles.
https://www.smh.com.au/environment/conservation/the-pinosaurs-being-fire-proofed-to-last-another-200-million-years-20180621-p4zmzo.html

Where the grass seems greener: Australia floats sustainability at Architecture Biennale

As far as the eye can see, thousands of plants form a sea of green. Among them are 65 species of grasses, all indigenous to Western Victoria. But this is not Australia – this is Venice, Italy, on the cusp of the Mediterranean summer. The exhibit's creators, architects Mauro Baracco and Louise Wright, in collaboration with artist Linda Tegg, sourced 10,000 rare indigenous plant seeds for the project. Wright says Australia's biodiverse grassland ecologies are often overlooked because they are "just" grass. "By putting it inside a cultural institution, you're asking people to look at it again, to revalue it, to reconsider," she says. "What we wanted to do was present the land that we occupy [in Australia] in a way that will make people look at it in a different way." Only 1 per cent of the natural habitat where the grasses at the Australia Pavilion come from remains. You can't generally buy these plants at your local nursery. The team instead worked with local seed banks, some of which collect seeds from areas cleared for urban development before construction begins.
https://www.smh.com.au/entertainment/art-and-design/where-the-grass-seems-greener-australia-floats-sustainability-at-architecture-biennale-20180525-p4zhi0.html

New office of environmental biosecurity will protect Australia's borders

Today's announcement by federal agriculture minister David Littleproud to establish an office of environmental biosecurity will better prepare Australia to prevent and respond to new harmful pest, weed and disease invasions. The decision was announced today as part of a $138 million boost in investment for national biosecurity, including $7.6 million over five years to establish the office, headed by an Environmental Biosecurity Protection Officer, within the Department of Agriculture and Water Resources. "This much-needed focus on environmental biosecurity will go a long way towards equalising the treatment of the environment in our national biosecurity system," Invasive Species Council CEO Andrew Cox said. "Australia suffers from a devastating legacy of feral cats, foxes, weeds and most recently myrtle rust. Every year at least 20 new potential weeds spread into the wild while numerous new feral animals, invasive fish, ants and exotic diseases of native plants and animals are discovered. The fungus myrtle rust, first detected in Australia eight years ago, continues to devastate one of our largest plant families, which includes eucalypts, melaleucas and lilli pillies. It is likely to make extinct in the wild a number of native plant species.
https://mailchi.mp/invasives/new-office-of-environmental-biosecurity-will-protect-australias-borders-1261585?e=cfc3e2bfac

Conferences and courses

Ecological Society of Australia 2018 Conference – Brisbane, 25-29 November 2018

ESA18 will be held at the Royal International Convention Centre (RICC) in Brisbane. The theme is 'Ecology in the Anthropocene', reflecting the era of great tribulation and yet great opportunity in which we live. Working out how people and nature can coexist on planet Earth is surely the grandest of all society's challenges, and the conference will explore how natural ecosystems function, how human activity has impacted them, and what can be done to reverse the biodiversity crisis. Located at the interface between temperate and tropical Australia, the Brisbane region hosts an enormous range of habitats. More than 400 bird species have been observed in the Brisbane area, and conference trips will treat attendees to a smorgasbord of biodiversity as well as picture-postcard landscapes ranging from majestic rainforest to idyllic islands. There will be an opportunity to participate in early morning nature walks prior the start of the conference each day. Call for Abstracts close 20 July 2018. Early-bird registration closes 14 September 2018.
http://esa2018.org.au/

Australasian Systematic Botany Society (ASBS) Conference – Brisbane, 3-7 December 2018

ASBS 2018 will be held at the Mt Coot-tha Botanic Gardens in Toowong, right next to the Queensland Herbarium. The theme of the conference, 'Mind the Gap', aims to highlight gaps in systematics be they biogeographic, taxonomic, funding, data or other. The conference will start with a workshop on how to review and write taxonomic manuscripts and eFlora profiles, followed by three days of symposia covering a wide range of topics including the discovery, evolution, and conservation of our threatened flora and fungi, the advancement of genomic tools in our discipline and how best to engage with traditional owners on biodiversity projects. Presentations will be a mix of oral presentations and lightning talk sessions for the posters. The conference will finish with a fieldtrip to Springbrook. Registration and Abstracts are now open! Early bird registration and Abstracts closes 15 September 2018.
https://systematics.ourplants.org/registration/

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Research round up

Editor's note: We've had some queries about the best way for APC readers to find the full text versions of these articles - a challenge for our many readers without current institutional affiliations. My first suggestion would be to type in the article title in "Google Scholar" to check if there is a link to a full text version of the article online. A second suggestion is to contact the authors, all articles have a "corresponding author" who can be contacted either by email, phone or post. There may be a third option for some: did you know many universities have programs for alumni to access their libraries? This can include online logins to access full text versions of journal articles. If you have a university degree, it might be worth investigating this option.

COMPILED BY KIRSTIN COWLEY

Centre for Plant Biodiversity Research, Canberra Email: Kirsten.Cowley@csiro.au

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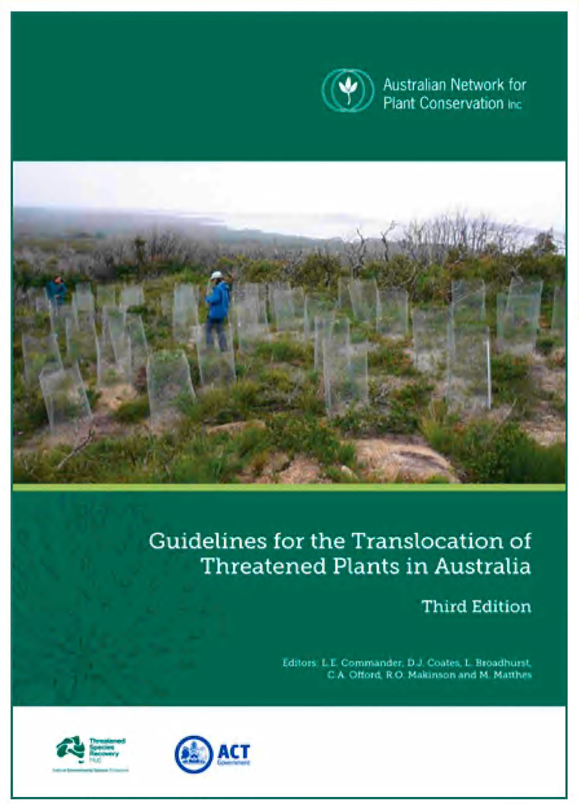

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Images: Leonie Monks, Rebecca Dillon and Sarah Barrett collecting seeds from a *Lambertia orbifolia* translocation (Photo: D Coates). *Grevillea wilkinsonii* flowers (Photo: J Briggs). Seedling recruitment of *Brachyscome muelleri* (white flower) being monitored with the assistance of a quadrat. (Photo: M Jusaitis). *Grevillea scapigera* inflorescences (Photo: S Krauss).

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